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CONTENTS

Page

Summary 1

Introduction 2

Experimental procedures 3
  Site selection 3
  Sampling techniques 5
  Laboratory methods 8

Results and discussion 9
  Nitrate distribution 9
  pH, Total salts, and water-soluble organic carbon 18
  Microbiological determinations 29
  Chemical analyses of water samples 34
  Dentirification 38
  Hydraulic conductivity measurements 42
  Maps, information, and detailed data for individual locations 46

Literature cited 205

LIST OF FIGURES

Page

Figure 1.--Northeastern Colorado, showing the locations (Nos. 1-19) where cores were taken 4

Figure 2.--Drilling assembly used for taking cores 5

Figure 3.--Sampling tube used for obtaining undisturbed cores (sleeves fit inside the tube and are removed with the soil intact) 6

Figure 4.--Histograms showing the distribution of nitrate found at increasing depths for cores taken from different land use areas 10-15

Figure 5.--Average nitrate-N distribution with depth of profiles . . 17

Figure 6.--Relationship between the redox potential measurements of the samples and the nitrate present in corrals 38

Figure 7.--Water percentages, nitrate, nitrite, conductivities, and bacterial counts at various depths for cores 16-B (corral) and 16-D (irrigated field) 39

Figure 8.--Histogram showing the number of samples and cores with hydraulic conductivities in the indicated ranges 42

Figure 9.--Histogram showing the distribution of hydraulic conductivities for cores taken from nonirrigated areas . . 43

Figure 10.--Histogram showing the distribution of hydraulic conductivities for cores taken from irrigated fields . . . 44

Figure 11.--Histogram showing the distribution of hydraulic conductivities for cores from corrals, as compared to those taken from other areas 45

Figure 12.--Average water content with depth of profiles 47

Figure 13.--Location 1 and core sites, near Fort Collins, Colo. 48

Figure 14.--Location 2 and core sites, near Fort Collins, Colo. 54

Figure 15.--Location 3 and core sites, near Loveland, Colo. 62

Figure 16.--Location 4 and core sites, near Johnstown, Colo. 68

Figure 17.--Location 5 and core sites, near Pierce, Colo. 74

Figure 18.--Location 6 and core sites, near Ault, Colo. 82

LIST OF FIGURES (contd.)

Page

Figure 19.--Location 7 and core sites, near Eaton, Colo. 88

Figure 20.--Location 8 and core sites, near Lucerne, Colo. 99

Figure 21.--Location 9 and core sites, near Peckham, Colo. 106

Figure 22.--Location 10 and core sites, near Brighton, Colo. 115

Figure 23.--Location 11 and core sites, near Brighton, Colo. 121

Figure 24.--Location 12 and core sites, near Prospect, Colo. 130

Figure 25.--Location 13 and core sites, near Prospect, Colo. 142

Figure 26.--Location 14 and core sites, near Wiggins, Colo. 152

Figure 27.--Location 15 and core sites, near Wiggins, Colo. 165

Figure 28.--Location 16 and core sites, near Fort Morgan, Colo. . . . 174

Figure 29.--Location 17 and core sites, near Brush, Colo. 184

Figure 30.--Location 18 and core sites, near Akron, Colo. 192

Figure 31.--Location 19 and core sites, near Julesburg, Colo. 199

LIST OF TABLES

Table 1.--Abbreviations used for the various materials 7

Table 2.--Water-soluble organic carbon, pH, and electrical conductivity of saturated paste extracts of 12 samples from corrals and irrigated fields 19

Table 3.--Counts of nitrifying and total bacteria per gram for samples from cores 16-B and 16-D 30

Table 4.--Nitrifying bacteria (Nitrosomonas) per gram in selected core samples of moist soil. 31

Table 5.--Sporulating and total bacteria per gram for selected core samples 33

LIST OF TABLES (contd.)

Page

Table 6.--Chemical analyses of water samples taken in the middle South Platte Valley of Colorado, 1966 34

Table 7.--Location 1: Chemical and physical analyses of cores and water samples taken near Fort Collins, Colo., 1966 . . . 50

Table 8.--Location 2: Chemical and physical analyses of cores and water samples taken near Fort Collins, Colo., 1966 . . . 56

Table 9.--Location 3: Chemical and physical analyses of cores and water samples taken near Loveland, Colo., 1966 64

Table 10.--Location 4: Chemical and physical analyses of cores taken near Johnstown, Colo., 1966 70

Table 11.--Location 5: Chemical and physical analyses of cores and water samples taken near Pierce, Colo., 1966 76

Table 12.--Location 6: Chemical and physical analyses of cores and water samples taken near Ault, Colo., 1966 83

Table 13.--Location 7: Chemical and physical analyses of cores and water samples taken near Eaton, Colo., 1966. 90

Table 14.--Location 8: Chemical and physical analyses of cores and water sample taken near Lucerne, Colo., 1966 101

Table 15.--Location 9: Chemical and physical analyses of cores and water samples taken near Peckham, Colo., 1966 108

Table 16.--Location 10: Chemical and physical analyses of cores and water samples taken near Brighton, Colo., 1966 116

Table 17.--Location 11: Chemical and physical analyses of cores and water samples taken near Brighton, Colo., 1966 123

Table 18.--Location 12: Chemical and physical analyses of cores and water samples taken near Brighton, Colo., 1966 132

Table 19.--Location 13: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966 144

Table 20.--Location 14: Chemical and physical analyses of cores and water samples taken near Wiggins, Colo., 1966 154

Table 21.--Location 15: Chemical and physical analyses of cores taken near Wiggins, Colo., 1966 167

LIST OF TABLES (contd.)

Page

Table 22.--Location 16: Chemical and physical analyses of cores and water samples taken near Fort Morgan, Colo., 1966 . . 176

Table 23.--Location 17: Chemical and physical analyses of cores taken near Brush, Colo., 1966 185

Table 24.--Location 18: Chemical and physical analyses of cores taken near Akron, Colo., 1966 193

Table 25.--Location 19: Chemical and physical analyses of cores taken near Julesburg, Colo., 1966 200

DISTRIBUTION OF NITRATES AND OTHER WATER POLLUTANTS UNDER FIELDS AND CORRALS IN THE MIDDLE SOUTH PLATTE VALLEY OF COLORADO[1]

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SUMMARY

One hundred and twenty-nine cores representing nonirrigated fields in native grass, cultivated nonirrigated fields, irrigated fields in alfalfa, irrigated fields in crops other than alfalfa, and corrals were obtained from northeastern Colorado during the period of April 26 through the week of August 8, 1966. Samples were taken at 1-foot intervals to the water table or bedrock, and water samples were taken in as many cases as possible with the sampling procedure used. Analyses for nitrate, ammonium, nitrite, redox potential, water percentage, and hydraulic conductivity were made on samples of all of the cores. In addition, organic carbon, pH, and conductivity of saturated paste extracts, and bacterial counts were determined on samples from selected cores.

Cores from cultivated nonirrigated fields usually contained small accumulations of nitrate below the root zone. This indicates some leaching of nitrate, even though the average rainfall for the area is only about 15 inches yearly. The native grass fields, as a rule, did not show nitrate accumulations in the profile. Significant quantities of nitrate were found in most cores taken from irrigated fields being cropped with row crops or cereal grains. On the other hand, cores obtained from irrigated alfalfa fields generally contained none (less than 0.5 p.p.m.), or insignificant amounts of nitrate.

The amounts of N as nitrate found under corrals were extremely varied, ranging from almost none to more than 5,000 pounds per acre in a 20-foot profile. A 1-acre corral containing this high level of nitrate, if all were leached into the ground water, could raise the nitrate content of approximately 200 acre-feet of water to 10 p.p.m. of nitrate-N, which is considered the maximum safe limit by the U.S. Public Health Service. Evidence was obtained, however, that denitrification was occurring under feedlots, even at several feet below the surface. Consequently, much of the nitrate present under the feedlots will probably never reach the water table. The relations of redox potentials, nitrite, and bacterial counts to the nitrate found under corrals are presented.

Water samples from beneath several corrals contained large amounts of organic carbon and ammonia and had an offensive odor. The bacterial counts under corrals were also considerably higher than under other areas, especially

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[1] Contribution from the Northern Plains Branch, Soil and Water Conservation Research Division, Agricultural Research Service, USDA, in cooperation with the Colorado Agr. Exp. Sta., Fort Collins, Colo.

[2] All authors are Soil Scientists except Dr. F. E. Clark, Microbiologist, Agricultural Research Service, USDA, Fort Collins, Colo.

at the lower depths. These findings indicate some pollution of the ground water by deep percolation is occurring from corrals, but more studies are required before the significance and magnitude of this pollution can be assessed.

Nitrate was found most of the water samples analyzed and, in many cases, the concentration exceeded the 10-p.p.m.-N concentration (45 p.p.m. nitrate) considered safe by the U.S. Public Health Service for human consumption. Water from beneath corrals was not noticeably higher in nitrate than water from under irrigated fields.

INTRODUCTION

Increased attention is being given to pollution of ground and surface waters. Increased regulation of sources of pollution at the local, State and Federal level can be anticipated. The quality of water may be changed in a number of ways and from various sources. Among these sources are industrial urban wastes, effluents from cities and towns and certain agricultural practices. Uncontrolled erosion resulting in excessive sediment in streams, soluble plant nutrients from fertilizers, and runoff and deep percolation of undesirable mineral and organic compounds from concentrated livestock operations may have adverse effects on water quality.

This report presents the results of one small phase of the total problem. Information is presented on what kinds of potential pollutants may be transmitted to the water table under various kinds of land management in the middle South Platte valley in northeastern Colorado.

The agricultural uses of the land studied included native grassland or its nearest equal, nonirrigated and irrigated cropland and farm and commercial cattle feedlots of different ages and use intensity. From the standpoint of land use, the area studied has many advantages. Use of commercial fertilizers, mainly on irrigated lands, has been steadily increasing. In Colorado as a whole, commercial fertilizer nitrogen sales on an elemental basis have increased almost fivefold in the last decade--from 7,041 tons in 1954 to 38,682 tons in 1964. In six counties in northern and northeastern Colorado, constituting about half of the area studied, commercial fertilizer nitrogen use in 5 years almost doubled from 9,216 tons in 1959 to 17,009 tons in 1964. There is no evidence of general excessive use. Many large commercial and farm cattle-feeding operations exist in the area studied. Some of the feedlots are operated continuously. Most of the feeding is located on the South Platte and its tributaries.

In these studies, nitrate and nitrogen compounds were given most emphasis. Information obtained from this study indicates that other potential water pollutants may be more significant than nitrates. Nitrate or nitrite nitrogen, at high enough concentrations in water supplies, may endanger the health of both man and animals. The U.S. Public Health Service, basing its conclusions on a survey conducted by Walton (11)[3], recommended that drinking water contain no more than 10 p.p.m. of NO_3-N (equivalent to 45 p.p.m. of NO_3). Infants are more susceptible to nitrate poisoning (methemoglobinemia or "blue babies") than are adults (2, 13). Among the livestock ruminants, particularly, cattle are the most susceptible.

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[3] Underscored figures in parentheses refer to Literature Cited, p. 205.

Nitrate nitrogen from natural deposits and from the normal decomposition of organic matter, occur in profiles and in ground water. These "natural" sources of nitrate cannot be neglected in any appraisal of potential nitrate pollution created by agricultural practices. Little is known regarding the magnitude of the sources of "natural" or man-added sources of pollution of ground waters. Smith (10) concluded that the contaminated aquifers in Missouri were closely associated with livestock feeding. Mink (4) studied the concentration of nitrate nitrogen in wells located in the unirrigated and irrigated regions of southern Oahu. The difference in mean concentrations of 1.0 ± 0.22 and 8.4 ± 24 p.p.m. was attributed to the percolation of nitrate added by fertilizers. In Nebraska (3), nitrate nitrogen was higher in shallow water tables than in deeper water tables. Water containing more than 10 p.p.m. was present in wells where the average depth to the water level was 38 feet. In contrast, water containing less than 2 p.p.m. was present in wells that had an average depth to the water level of 61 feet.

This report is presented as a compilation of all of the data obtained during the study. Some tentative conclusions have been based on this data. With additional studies more complete conclusions may be drawn.

EXPERIMENTAL PROCEDURE

Site Selection

The area chosen for the study is located in northeastern Colorado. It contains the conditions that raise concern whether nitrate, nitrite, and other compounds are moving through the soil and into the ground water. Studies of Parshall (6) on return flow to the South Platte show repeated recycling of the surface waters of this watershed until they eventually flow into Nebraska. Corn and sugar beets, requiring high nutrient levels for peak production, are among the chief crops grown in the area. Large feedlot operations are also prevalent, and a water table, ranging from 10 to 70 feet beneath the surface, is present in much of the area.

The general location of the various sites selected is shown in figure 1. A detailed map of each location, showing the place where individual cores were obtained, is presented in the results section of this report. Locations were chosen to represent varying soils, water table depths, and soil uses. Insofar as possible, locations were selected that had corrals, irrigated fields, and nonirrigated fields within the same soil type. This selection allows a comparison of the effects of feedlot operations with effects of intensified farming where heavy applications of plant nutrients are frequent. Nonirrigated areas, where available, served as a control, since these fields have, in most cases, never received fertilizer. In some cases, the nonirrigated areas were playgrounds around schoolhouses or were waste areas. However, these areas should still provide a reliable check on geologic deposits or natural amounts of nitrate in the profile.

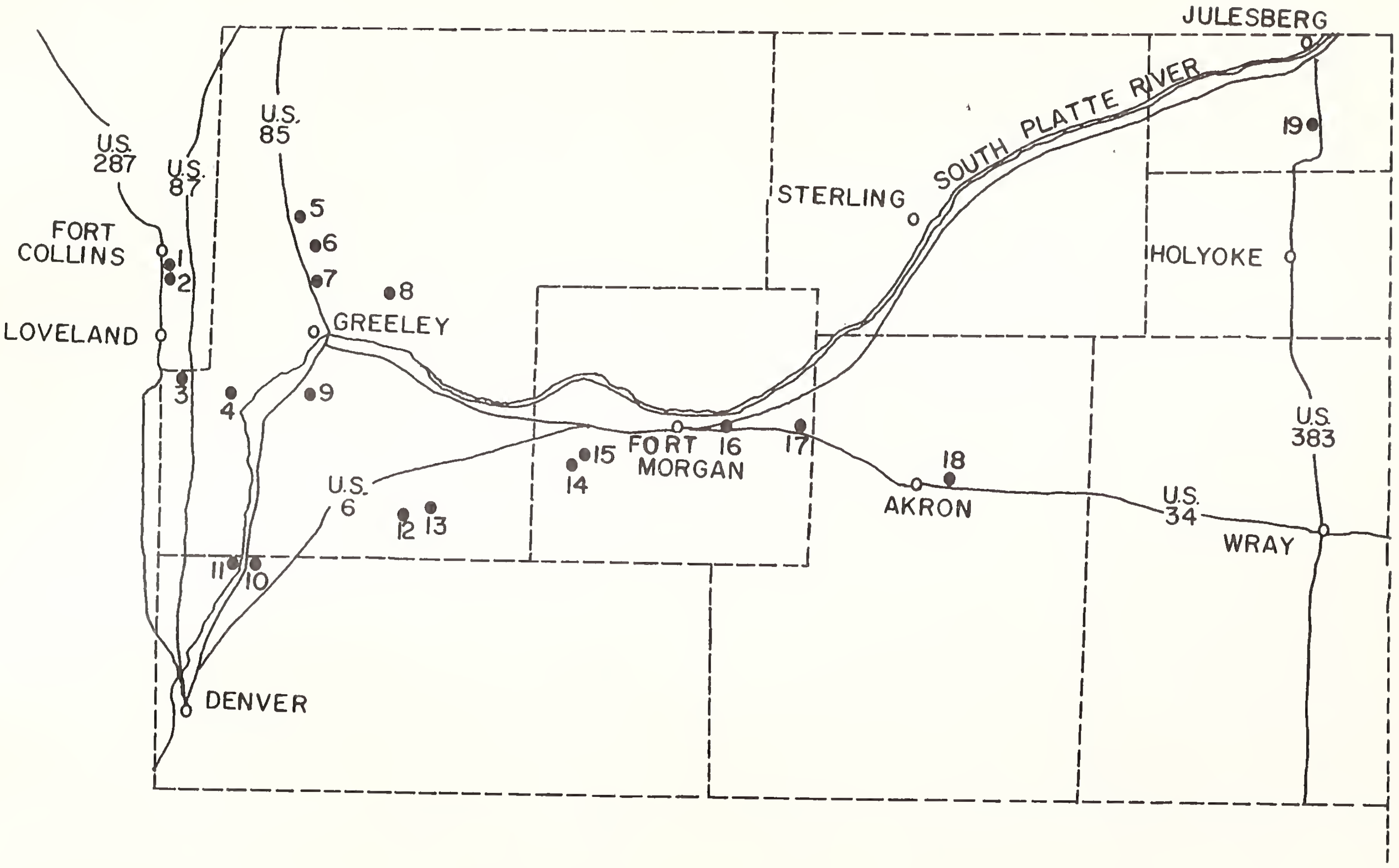

Figure 1.--Northeastern Colorado, showing the locations (Nos. 1 to 19) where cores were taken.

The cores were taken during the period of April 26 through July 21, 1966, with the exception of location 19. Location 19 was sampled during the week of August 8, 1966. The order of sampling the locations was roughly the same as presented in figure 1, beginning with location 1 and ending with location 19. The earlier samplings were before any irrigation in the season. However, many of the fields sampled later had received at least one application of irrigation water. Fields irrigated during 1966 before sampling are represented by cores 6-E, 6-F, 9-J, 10-E, 11-J, 11-A, 11-B, 11-C, 12-C, 12-D, 13-C, 13-D, 14-G, 14-H, 15-A, 15-B, 16-D, 16-E, and 16-F. These fields for the most part, received only light irrigations to aid in the germination of spring seeded crops. It is not believed that these irrigations had any pronounced effect on the distribution of nitrate, except near the surface. Rainfall during the sampling period was very low, except during August when location 19 was sampled.

Sampling Techniques

Core samples were taken with a truck-mounted drilling rig shown in figure 2.[4] The rig consisted of a hydraulic feed, a rotary drill head, and provisions for driving a sampler with a 140-pound weight. Core samples were taken with a 2-inch-diameter (i.d.), 3-foot-long sampling tube. With the hydraulic feed, the tube was pushed into the soil to a depth of 2 feet. The sampling tube was then replaced with the sampler shown in figure 3.

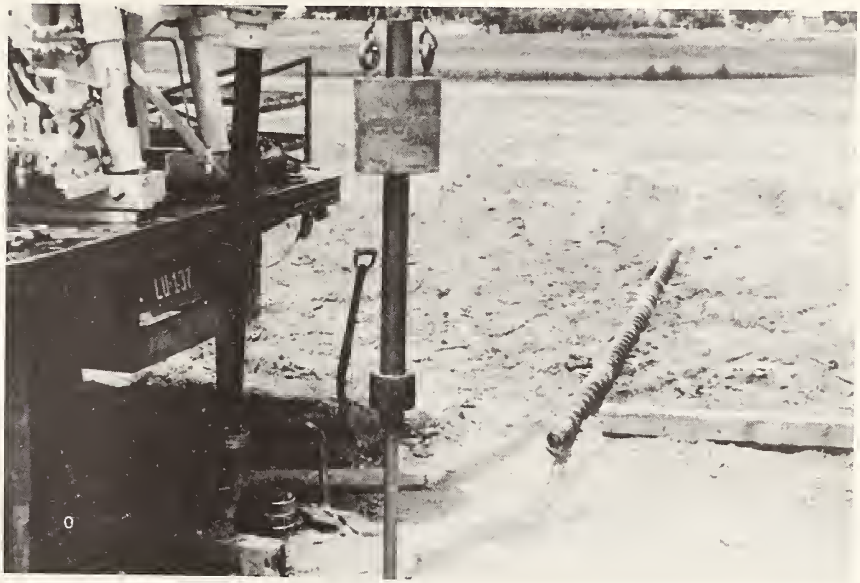

Figure 2.--Drilling assembly used for taking cores.

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[4] A contract for the drilling was awarded to Drilling Engineers, Inc. of Fort Collins, Colo. Appreciation is extended to W. E. Steige and C. C. Smith, registered professional engineers with Drilling Engineers, Inc., for their assistance in developing the sampling techniques used in the study.

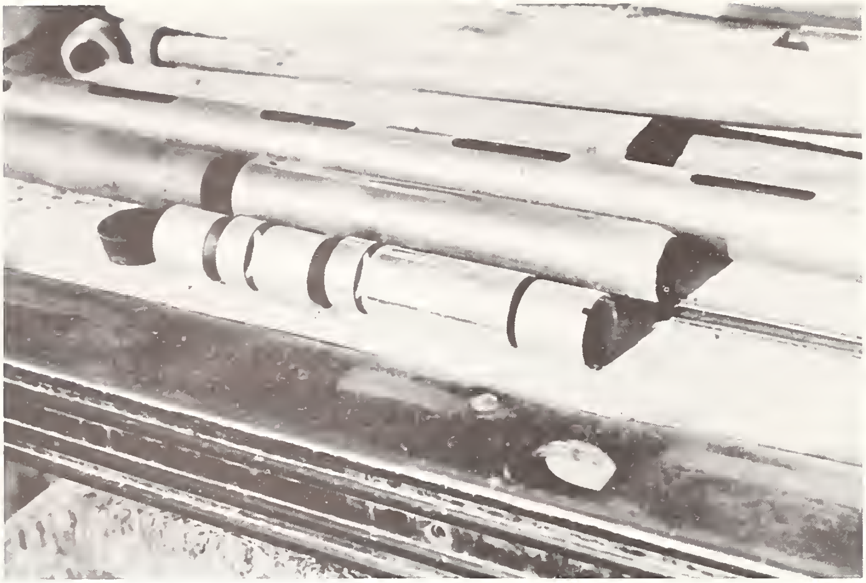

Figure 3.--Sampling tube used for obtaining undisturbed cores (sleeves fit inside the tube and are removed with the soil intact).

This sampler was used to obtain undisturbed cores for studying the rate of water movement through the profile. The undisturbed cores were generally taken at depths of 2-3, 5-6, 8-9 feet, but attempts for cores at other sites were discontinued at depths where the sampler could not be pushed with the hydraulic feed. Between these depths, samples were obtained with the 3-foot sampling tube described above. When difficulty of entry and removal of the tubes was encountered, the hole was enlarged to a 4-inch diameter with a continuous flight auger to the depth that cores had been obtained. The auger was removed, and the sampling procedure continued. When the sampler could no longer be hydraulically pressed through the earth, the tube was driven with the weight. In compacted sands or gravel, the 2-inch-diameter sampling tube was replaced with a 1-3/8 -inch split-tube sampler. This sampler was stronger structurally and the smaller diameter tube could be used without cave-in of the soil material, even when the material was very dry.

As samples were removed from the sampling tubes, the redox potential (Eh) was measured at field water content and the samples were then sealed in vapor-tight cans for transport to the laboratory. The redox potentials were measured by pressing firmly into the sample a platinum electrode and reading the potential at the end of 30 seconds. The instrument was calibrated according to the methods outlined by Patrick and Wyatt (8). The values are reported in millivolts versus the standard hydrogen electrode.

The texture of the material was estimated by feel in the field. The textures were, with few exceptions, estimated by the same individual. Although these estimated textures might vary from those found by a laboratory analysis, they are relative to one another and furnish a knowledge of the sharp changes in texture found in many of the cores. A knowledge of the changes is important in interpreting the water and mineral contents found in the cores. A key to the abbreviations used for the textural classes is given in table 1.

Table 1.--Abbreviations used for the various materials

Material	Symbol 1/
Manure	M
Gravel	G
Gravelly sand	GS
Sand	S
Loamy sand	LS
Sandy loam	SL
Loam	L
Silt loam	SiL
Silt	Si
Sandy clay loam	SCL
Clay loam	CL
Silty clay loam	SiCL
Sandy clay	SC
Silty clay	SiC
Clay	C
Shale	Sh
Sandstone	Sst

1/ In the tables, when letters are separated by a hyphen, these letters indicate layers of different textured materials.

Water samples were obtained when the supply in the core holes was adequate. In many cases, water would be trapped above the soil core. When the soil material was to coarse to hold the water in the tube, a small bottle with a weight in it was lowered into the hole and a water sample was bailed out.

Laboratory Methods

The samples were brought into the laboratory on the day of collection and stored overnight in a room cooled to 4°C. Approximately 40 g. of each sample was taken from the containers and placed in a small jar and frozen. These subsamples were later used for NH_4^+, NO_2^-, and microbiological analyses. The rest of the soil was weighed, dried at 55°C., and reweighed to determine the water content. The dried samples were used for all subsequent analyses.

Analyses for NH_4^+ and NO_2^- were made on 1 N KCl extracts of the frozen samples. The NH_4^+ was measured by distillation with MgO. The NO_2^- was determined colorimetrically (1). Nitrates were analyzed by the phenoldisulfonic acid procedure (1). On a few cores, analyses for total salts, water-soluble carbon, pH, and water-soluble inorganic and organic phosphorus were made on the dried samples. For these analyses, a saturation extract was made (1) and analyses carried out on the extract. Total salts were estimated from electrical conductivity (1). Carbon was determined by the Walkley and Black procedure (1), modified so that the reagents were one-fiftieth the strength commonly used. Phosphorus was determined by the procedure of Watanabe and Olsen (12). The pH measurements were made with a glass electrode. Analyses on the water samples were made with the same methods.

Microbiological examinations were made on a limited number of core samples. The microbial populations most commonly determined were total, aerobic spore-forming, and nitrifying bacteria. Total bacteria were enumerated by the dilution plate method employing soil-extract agar (1), and sporulating bacteria on peptone agar following pasteurization of the inocula (1). Numbers of Nitrosomonas were determined by the extinction dilution or most-probable-number technique (1), employing tenfold serial dilutions with five replicate tubes of a mineral salts-ammonium sulfate solution being inoculated from the individual serial dilutions.

Hydraulic conductivity (K) was estimated by placing gaskets and end plates on each end of the sample that was otherwise enclosed by a 2-inch-diameter aluminum cylinder 2 inches long. The procedure involved centrifuging the samples to displace a slight amount of the water toward one end of the sample until equilibrium was obtained between the centrifugal forces and the capillary suction forces that tend to return the water to the dry end. The sample was then taken out of the centrifuge and placed with one end on a fulcrum and the other end on one pan of an analytical balance. The rate at which the water moved back toward the drier end was estimated from the change in weight observed on the balance. The line relating weight to time was extrapolated back to zero time; that is, when the sample was taken out of the centrifuge and the estimated rate of movement at zero time was coupled with the capillary suction force (which had to be in equilibrium with the known centrifugal force) to compute the hydraulic conductivity of the sample.

RESULTS AND DISCUSSION

The initial parts of this section deal with the overall trends and findings. The detailed data for the individual cores, along with a map and significant information for each location, are presented at the end of this section.

Nitrate Distribution

The nitrate present at various depths for cores from each land use is shown in the histograms presented in figure 4. The height of the bars represents the number of cores taken to the specified depth that contained nitrate in the quantity represented by the bar. As the depth increases, there are fewer cores represented because the majority of the cores were less than 35 feet and several were less than 20 feet in depth.

Nonirrigated sites

The data for the nonirrigated sites are separated into those from cultivated areas and those from sod areas. There is a distinct difference in the distribution patterns for the two groups. Most of the cores from the sod sites contained no nitrate-N (less than 0.5 p.p.m.). For example, at the 10-foot depth, 12 of the 17 cores contained no nitrate-N. Of the 22 cultivated cores at the same depth, only five were free from nitrate. There were several cores from the cultivated areas that contained more than 3 p.p.m. N as nitrate, whereas only rarely did samples from the virgin areas contain more than 3 p.p.m. nitrate-N. Cores 14-E and 14-F are included in figure 4, although there was possible contamination of these cores from irrigation runoff water (see detailed data and writeup for location 14). This accounts for two of the cores containing high amounts of nitrate and should be kept in mind when interpreting the data.

The differences in the nitrate content of the cores from cultivated areas as compared with sod areas are largest at depths of about 8 to 20 feet. This accumulation of nitrate in the cultivated sites probably results from nitrification during fallow seasons followed by leaching of the nitrate below the root zone in years of above-average rainfall. Nitrogen under sod areas is not subject to the same degree of leaching, because grass is always present to absorb it as soon as organic matter and dead plants decompose.

Irrigated Fields

The irrigated field cores are separated into two groups--those in alfalfa when sampled and those in other crops, primarily sugar beets and corn. There is a large difference in the amounts of nitrate present under these different cropping systems. The cores taken from the alfalfa fields showed little nitrate present at the 10-foot depth; 11 of the 13 cores showed no (less than 0.5 p.p.m.) nitrate-N present. Similar results are shown at the other depths. On the other hand, the cores from the other irrigated fields showed significant quantities of nitrate present. At the 10-foot depth for these cores, only 8 of the 23 cores showed no nitrate present, and 5 contained more than 3 p.p.m. N as nitrate. At the 20-foot depth, three cores showed no nitrate, whereas

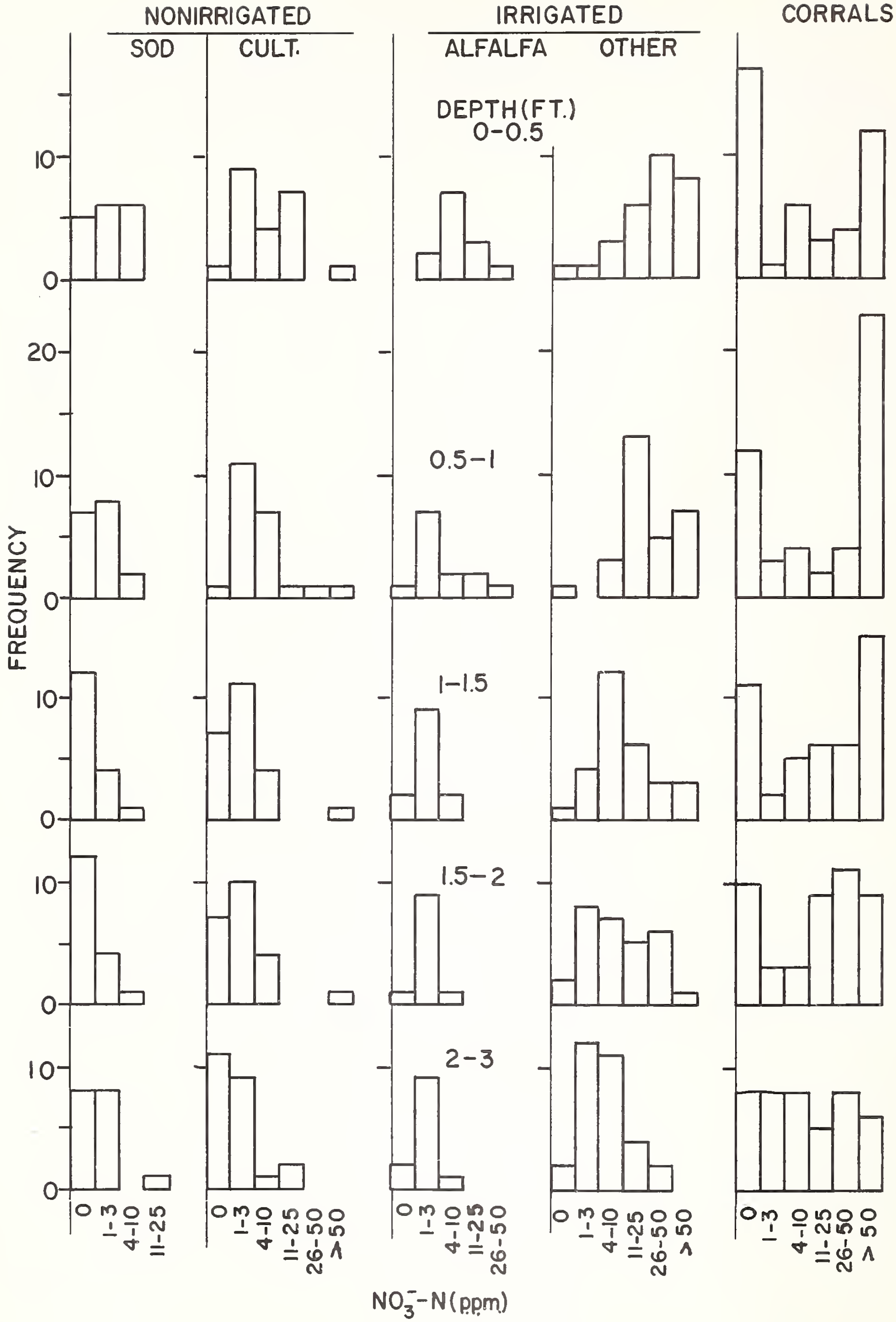

Figure 4.--Histograms showing the distribution of nitrate found at increasing depths for cores taken from different land use areas.

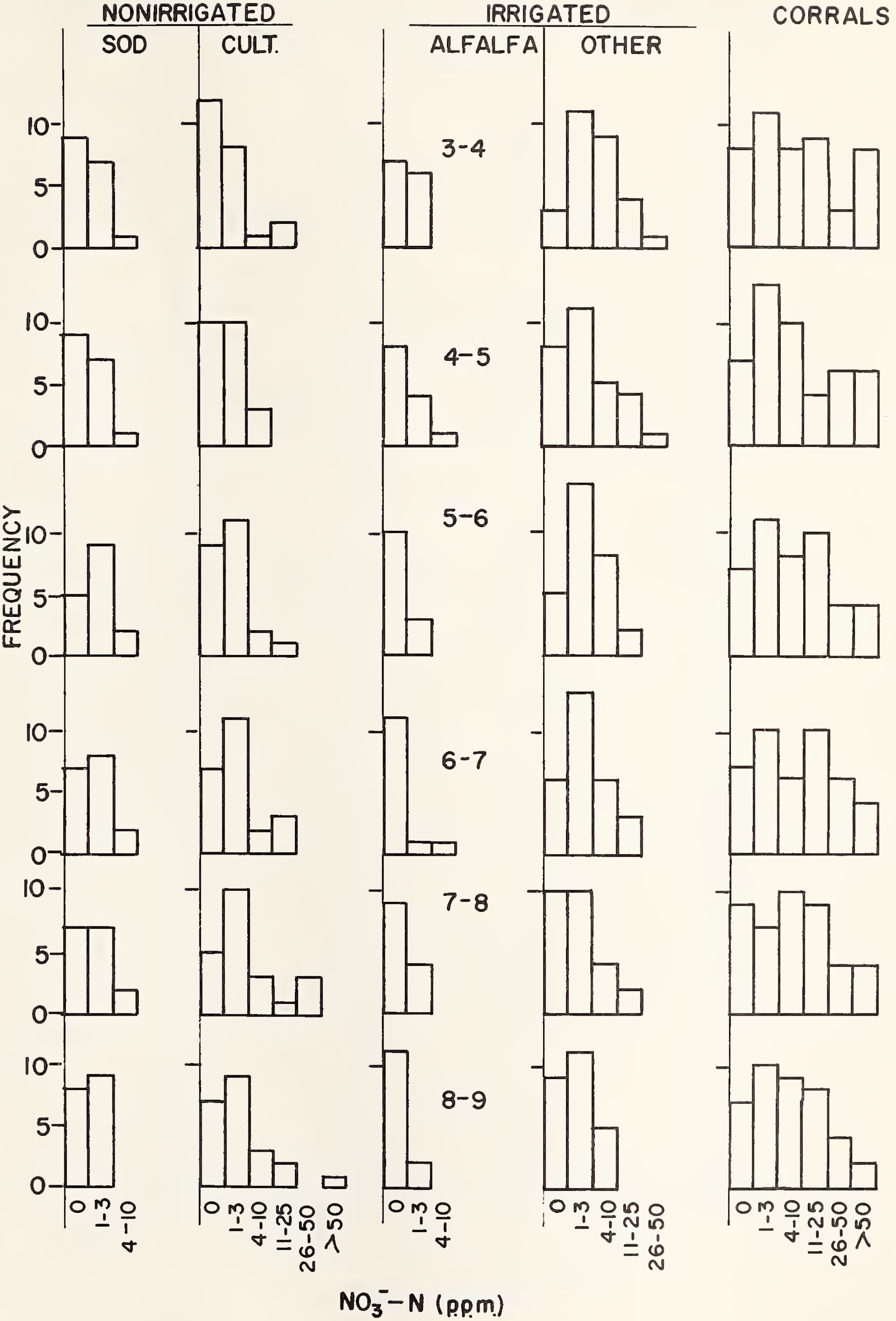

Figure 4.--Histograms showing the distribution of nitrate found at increasing depths for cores taken from different land use areas--Continued.

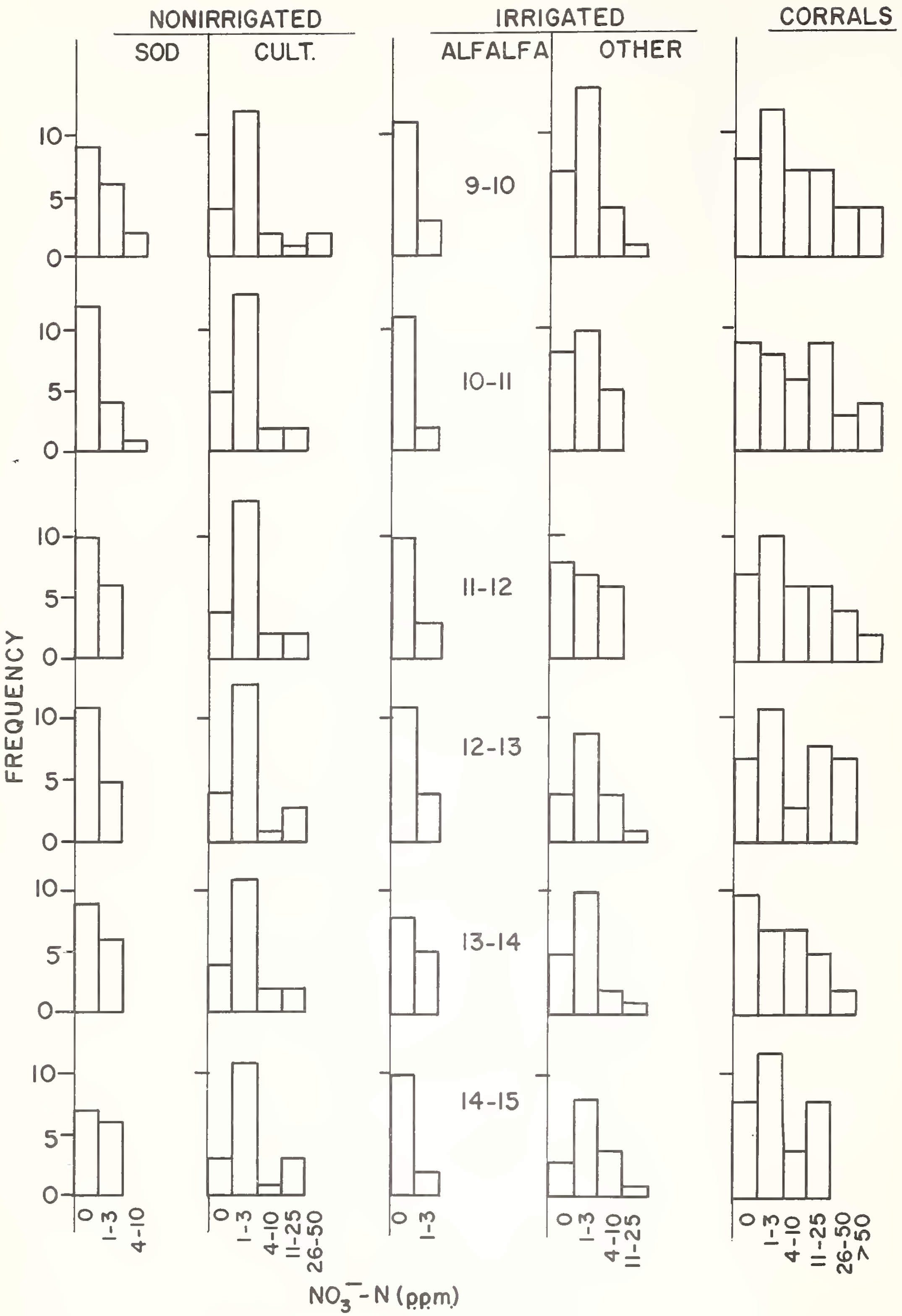

Figure 4.--Histograms showing the distribution of nitrate found at increasing depths for cores taken from different land use areas--Continued.

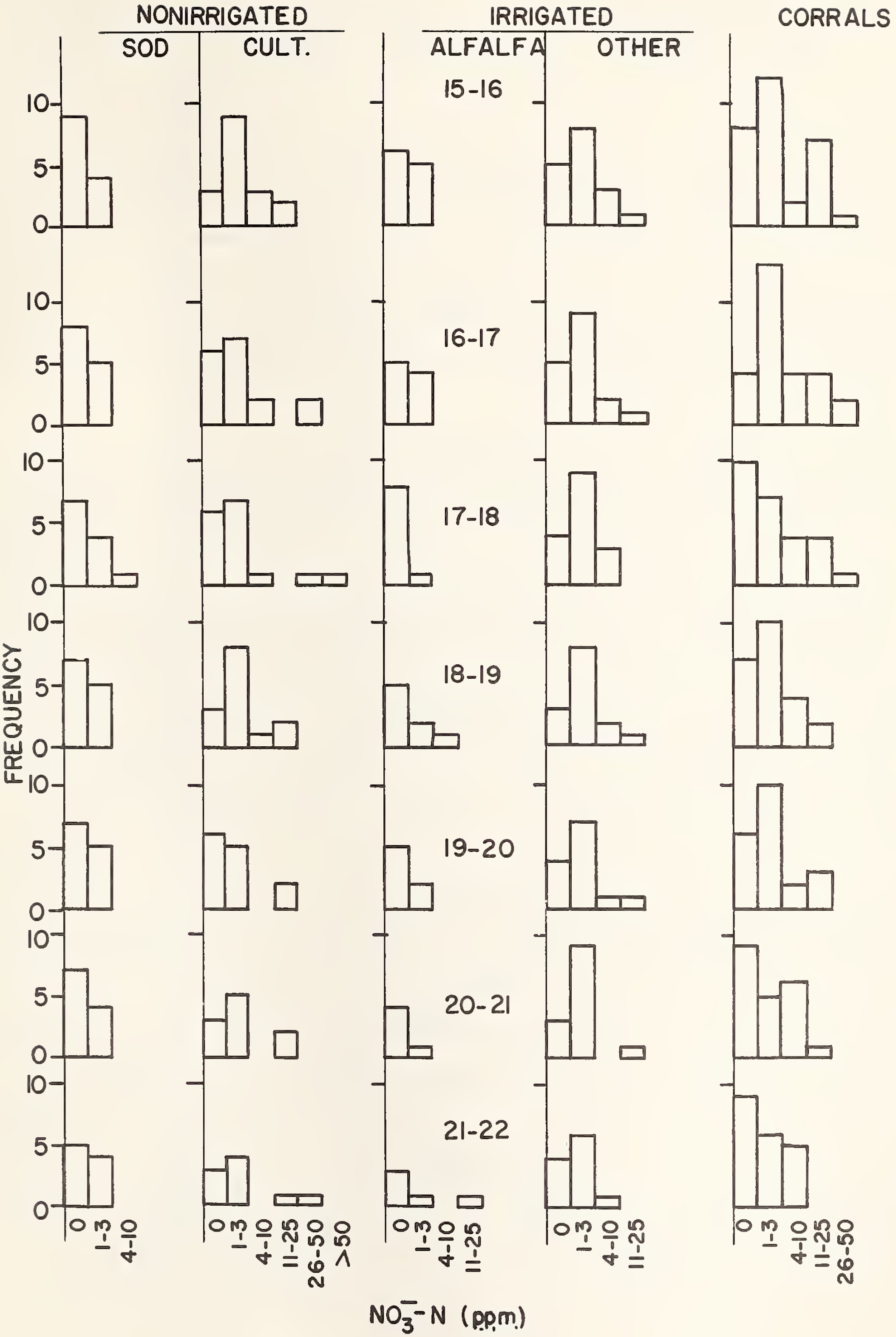

Figure 4.--Histograms showing the distribution of nitrate found at increasing depths for cores taken from different land use areas--Continued.

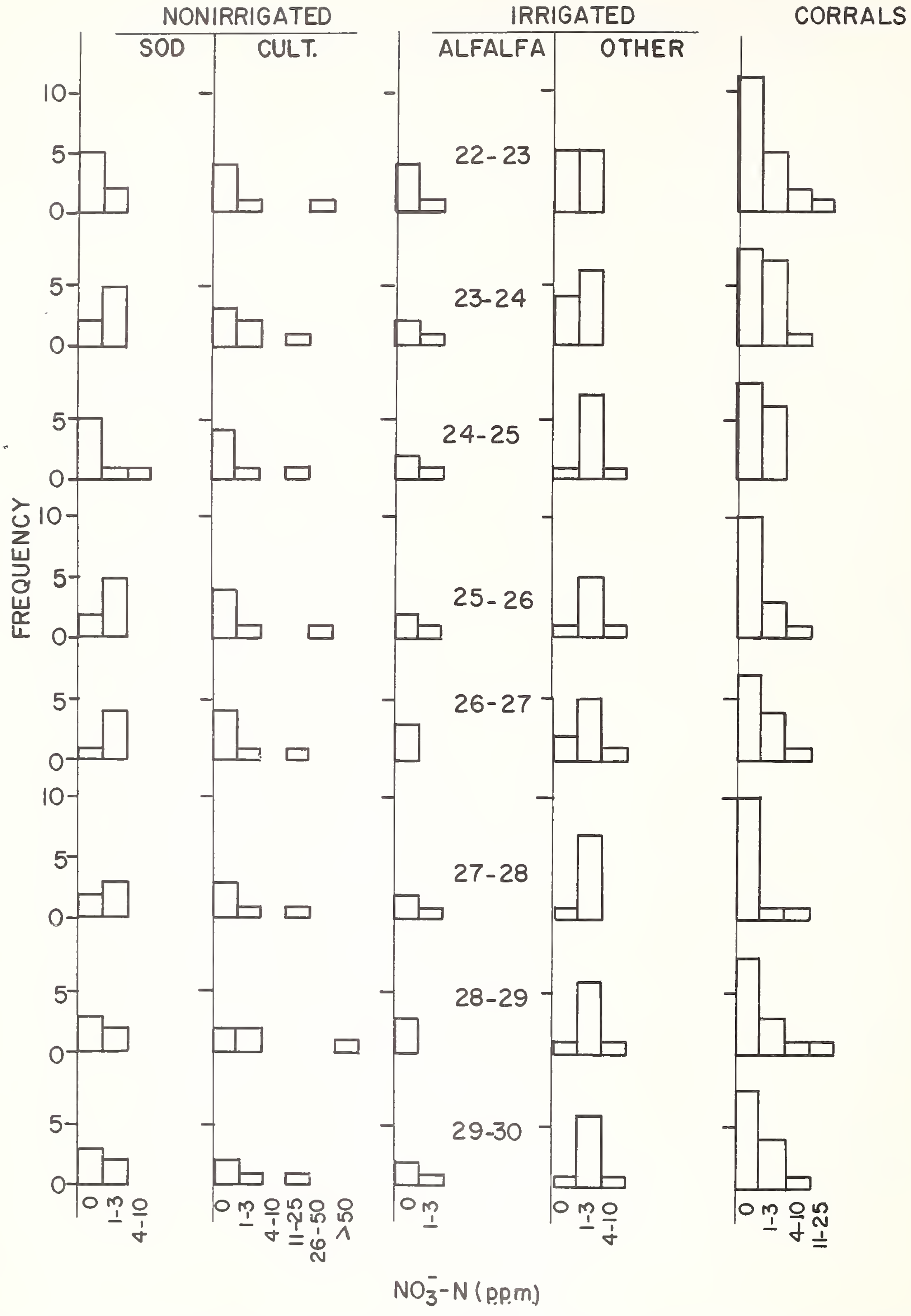

Figure 4.--Histograms showing the distribution of nitrate found at increasing depths for cores taken from different land use areas--Continued.

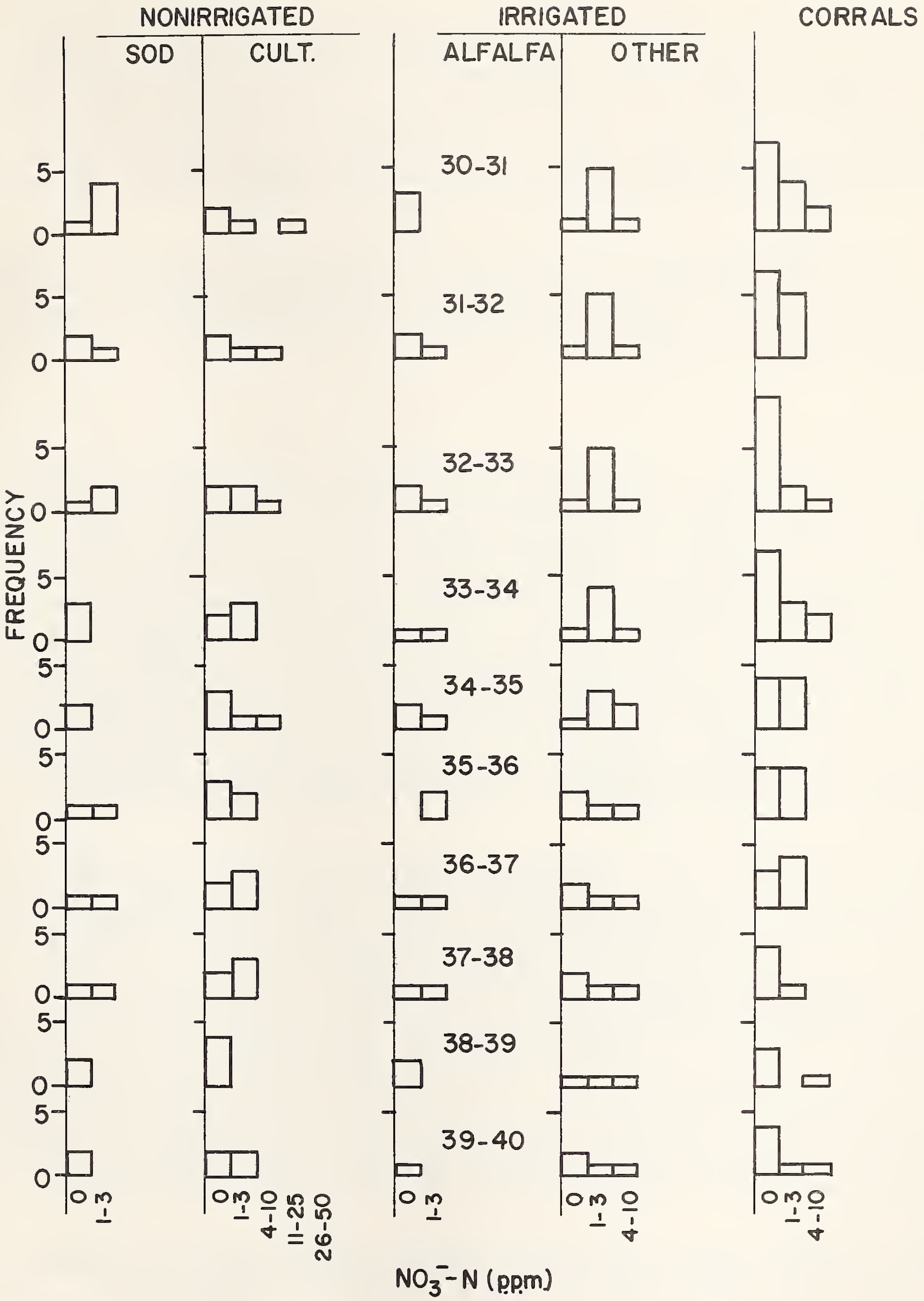

Figure 4.--Histograms showing the distribution of nitrate found at increasing depths for cores taken from different land use areas--Continued.

nine cores contained from 1 to 3 p.p.m. N as nitrate and one core contained more than 11 p.p.m. nitrate-N. These data indicate that nitrate is being leached through the soil when corn, sugar beets, beans, onions, cereal grains, and other crops are grown. The absence of nitrate in the cores taken from alfalfa fields is probably caused by absorption by the deep-rooted plants and the fact that nitrogen fertilizers are not added to an alfalfa crop. Any nitrate present in the soil at the time of alfalfa seeding was removed by the alfalfa or leached out of the profile by irrigation water.

Conclusions regarding the relation between period of time since alfalfa and nitrate accumulation in the profile cannot be safely drawn from the data. The differences between farmers regarding irrigation practices and amounts of fertilizer used are so great that many samples would be needed before valid conclusions could be drawn.

Corrals

The corral data show that in the shallow depths there tended to be either no nitrate or high levels of nitrate present. This is illustrated by the U-shape of the histograms for the 0- to 0.5- and 0.5- to 1-foot depths. When the 0.5- to 1-foot depth is compared to the 0- to 0.5-foot depth, there were fewer samples containing no nitrate and more that contained greater than 50 p.p.m. nitrate-N. In many cases, the 0- to 0.5-foot depth mainly represented manure accumulation, which has a high oxygen demand during decomposition. The relationship between redox potential and nitrates will be discussed later in the denitrification section. The histograms for the corral cores also show that significant amounts of nitrate were present in many of the deeper core samples. At the 10-foot depth, 22 of the 39 cores contained more than 3 p.p.m. N as nitrate. These data indicate that nitrate is moving through the soil under many of the corrals sampled, although the concentration decreases rapidly with increasing depth.

As will be seen later in the section showing detailed data for the individual cores, the amounts of nitrate-N under corrals were extremely varied. The totals found ranged from practically none to more than 5,000 pounds per acre in a 20-foot profile. A 1-acre corral containing this high level of nitrate, if all were leached into the ground water, could raise the nitrate-N level of approximately 200 acre-feet of water to 10 p.p.m., which is considered as the maximum safe limit by the U.S. Public Health Service for human consumption. Evidence of denitrification will be presented later in the text which makes it improbable that all of this nitrate will ever reach the water table. In addition, Navone et al. (5) have recently shown that several domestic sources of water with high levels of nitrate are being used in southern California with no known harmful effects resulting. More studies are needed to clarify the health hazards resulting from the presence of nitrate in drinking water.

Figure 5 shows the average nitrate distribution with depth of profiles from corrals (47 cores), irrigated fields in crops excluding alfalfa (28 cores), and dryland cropped fields (21 cores). The comparatively high nitrate concentrations under corrals and the decrease with depth, presumably due to denitrification, are apparent as will be discussed later. The

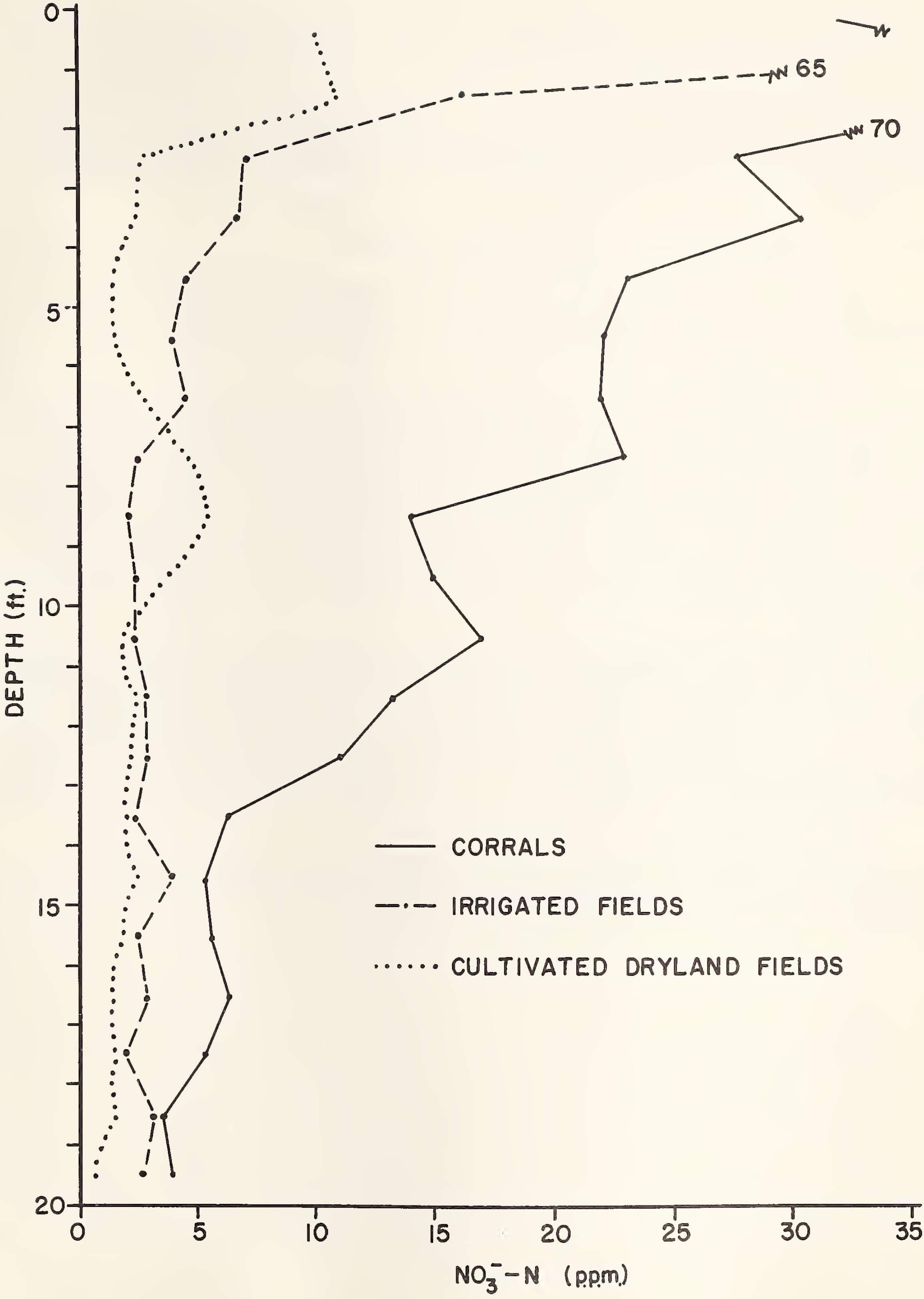

Figure 5.--Average nitrate-N distribution with depth of profiles.

accumulation of nitrate between 7 and 10 feet below the rooting depth of dryland crops is significant in relation to the historic loss of total nitrogen from the surface of dryland cropped soils. The nitrate-N concentrations under native grassland and alfalfa at the various depths were very low and are not shown. The average total nitrate-N to a depth of 20 feet in the profiles for the various kinds of land use were alfalfa, 79; native grassland, 90; cultivated dryland, 261; irrigated fields not in alfalfa, 506; and corrals, 1,436 pounds per acre.

pH, Total Salts, and Water-Soluble Organic Carbon

The pH, total salts, and water-soluble carbon were determined on saturated paste extracts of samples from 12 cores taken from corrals or irrigated fields as indicated in table 2.

The concentration of salts was higher in cores taken from corrals than in those obtained from irrigated fields. The average electrical conductivity (EC_e) for all samples obtained below 2 feet in corrals was 1.7 mmho/cm. compared to 1.0 for all samples obtained at the same depth under irrigated fields. The differences were greatest for sites 9 and 16. For site 16, EC_e of corral samples and irrigated field samples below 2 feet averaged 2.2 and 1.3 mmho/cm., respectively. For site 9, the averages were 1.0, 1.8, and 2.8 mmho/cm. for an irrigated field, a 4-year-old corral, and a 30-year-old corral, respectively.

Soluble organic carbon was also higher in cores from corrals, and like the salts, the larger differences occurred at sites 9 and 16. Water-soluble organic carbon averaged 9 p.p.m. in the samples of the irrigated field and 17 p.p.m. for the corral samples of site 16. The averages were 16, 19, and 38 p.p.m. for the irrigated field, the 4-year corral, and the 30-year corral samples, respectively, from location 9. Only samples below 2 feet in depth were used to obtain the averages.

The pH values of the samples were similar for all the profiles analyzed. The average pH was 7.9 for the samples taken from irrigated fields, compared to 7.8 for those obtained from corrals.

Table 2.--Water-soluble organic carbon, pH, and electrical conductivity of saturated paste extracts of 12 samples from corrals and irrigated fields

Core and depth (feet)	pH	Electrical conductivity	Carbon	
			Dry-wt. basis	In soil solution
		Mmho/cm.	p.p.m.	p.p.m.
Core 1-A (corral):				
0.3-.5	7.6	9.6	--	--
0.5-1	7.7	6.0	--	--
1-1.5	7.6	4.0	63	310
1.5-2	7.8	3.2	48	230
2-3	7.9	2.6	--	--
3-4	8.1	1.4	21	120
4-5	8.2	1.1	18	100
5-6	8.1	1.1	23	96
6-7	8.1	.9	21	92
7-8	8.2	.8	14	64
8-9	7.9	.8	45	260
9-10	7.9	.8	21	130
10-11	7.9	.7	11	66
Core 1-B (corral):				
0.5-1	7.6	5.0	130	740
1-1.5	7.7	3.6	80	430
1.5-2	7.7	3.0	72	380
2-3	--	--	--	--
3-4	7.9	1.3	24	84
4-5	7.8	.9	27	140
5-6	--	--	--	--
6-7	7.8	.9	18	73
7-8	7.7	.7	14	67
8-9	7.9	.6	25	130
9-10	7.7	.8	27	130
10-11	7.7	.5	22	110
11-12	7.8	.6	13	66
12-13	7.6	.6	15	69

Contd.

Table 2.--Water-soluble organic carbon, pH, and electrical conductivity of saturated paste extracts of 12 samples from corrals and irrigated fields--Continued

Core and depth (feet)	pH	Electrical conductivity	Carbon	
			Dry-wt. basis	In soil solution
		Mmho/cm.	p.p.m.	p.p.m.
Core 1-C (irrigated field):				
0-0.5	7.8	0.8	190	1,100
0.5-1	7.9	.7	100	500
1-1.5	7.9	.4	60	290
1.5-2	7.9	.5	49	230
2-3	8.0	.8	39	190
3-4	8.0	.6	32	150
4-5	8.1	.7	26	120
5-6	--	--	--	--
6-7	8.1	.7	23	120
7-8	8.0	.7	13	53
8-9	8.1	.6	15	74
9-10	8.1	.3	11	54
10-11	8.1	.3	11	63
11-12	8.0	.7	8	40
12-13	7.9	.6	10	40
13-14	8.0	.8	9	40
14-15	8.0	.4	8	50
Core 1-D (irrigated field):				
0-0.5	7.8	1.0	190	1,000
0.5-1	7.7	1.0	100	490
1-1.5	8.0	.6	59	280
1.5-2	7.9	.7	57	270
2-3	--	--	--	--
3-4	8.1	.9	37	170
4-5	8.2	.6	19	84
5-6	--	--	--	--
5-7	7.9	.6	29	130
7-8	8.1	.6	25	130
8-9	8.1	.5	15	75
9-10	8.1	.5	14	71

Contd.

Table 2.--Water-soluble organic carbon, pH, and electrical conductivity of saturated paste extracts of 12 samples from corrals and irrigated fields--Continued

Core and depth (feet)	pH	Electrical conductivity	Carbon	
			Dry-wt. basis	In soil solution
		Mmho/cm.	p.p.m.	p.p.m.
Core 1-D (contd.)				
10-11	8.0	.5	14	87
11-12	7.9	.6	14	76
12-13	8.0	.5	14	77
13-14	7.9	.5	13	48
14-15	8.0	.5	13	66
Core 7-B (irrigated field):				
0-0.5	7.8	2.4	160	900
0.5-1	7.8	1.5	66	470
1-1.5	8.0	.6	31	260
1.5-2	8.0	.5	21	180
2-3	7.9	.8	40	310
3-4	8.1	.6	19	140
4-5	8.1	.8	12	77
5-6	8.0	1.1	21	140
6-7	7.9	1.5	10	83
7-8	7.9	1.5	10	75
8-9	7.6	1.3	23	110
9-10	7.4	1.0	16	88
10-11	7.4	.7	13	96
11-12	7.4	.7	10	71
12-13	7.4	.7	8	80
13-14	7.7	.8	6	60
14-15	7.9	.6	4	50
15-16	7.6	.7	4	80
16-17	7.7	.6	7	60
17-18	8.1	.4	4	80
18-19	8.1	.5	3	70
19-20	8.2	.5	4	80
20-21	8.1	.5	1	30
21-22	8.0	.6	4	60

Contd.

Table 2.--Water-soluble organic carbon, pH, and electrical conductivity of saturated paste extracts of 12 samples from corrals and irrigated fields--Continued

Core and depth (feet)	pH	Electrical conductivity	Carbon	
			Dry-wt. basis	In soil solution
		Mmho/cm.	p.p.m.	p.p.m.
Core 7-B (contd.)				
22-23	8.2	.6	8	200
23-24	8.2	.6	6	200
24-25	8.2	.7	6	200
25-26	7.8	.6	5	60
26-27	8.1	.8	6	100
27-28	8.1	1.2	5	50
28-29	8.2	1.3	5	40
29-30	8.1	1.2	7	60
Core 7-D (corral):				
0.2-0.5	7.1	12.0	310	1,400
0.5-0.8	7.0	8.0	140	590
0.8-1.5	7.4	6.5	96	520
1.5-2	7.7	4.0	38	230
2-3	7.9	1.8	29	190
3-4	7.9	--	6	40
4-5	8.0	1.3	14	100
5-6	8.0	1.2	17	160
6-7	8.0	1.1	18	130
7-8	8.1	1.0	16	110
8-9	8.1	.9	17	150
9-10	8.1	.9	13	50
10-11	8.1	.8	9	40
11-12	8.1	.9	4	20
12-13	8.1	.8	7	70
13-14	--	--	--	--
14-15	7.8	.9	5	60
15-16	8.1	.9	5	70
16-17	8.2	.9	2	30
17-18	8.3	.7	3	40
18-19	8.4	.7	4	60
19-20	8.2	.7	2	20
20-21	8.1	.9	5	30
21-22	8.1	1.0	5	30

Contd.

Table 2.--Water-soluble organic carbon, pH, and electrical conductivity of saturated paste extracts of 12 samples from corrals and irrigated fields--Continued

Core and depth (feet)	pH	Electrical conductivity	Carbon	
			Dry-wt. basis	In soil solution
		Mmho/cm.	p.p.m.	p.p.m.
Core 7-D (contd.)				
22-23	8.1	1.2	14	230
23-24	--	--	--	--
24-25	8.2	.7	6	80
25-26	8.0	.9	9	60
26-27	7.9	.9	9	80
27-28	8.0	.8	5	40
28-29	8.0	1.1	13	150
29-30	8.1	1.0	5	30
30-31	7.9	2.2	17	130
31-32	8.1	1.1	10	50
32-33	8.2	1.2	7	50
33-34	8.0	1.2	5	40
Core 9-C (irrigated field):				
0-0.5	6.9	3.2	110	910
0.5-1	7.2	1.5	88	640
1-1.5	7.3	.8	49	370
1.5-2	7.3	.8	48	290
2-3	--	--	--	--
3-4	7.9	1.1	20	140
4-5	7.9	.9	16	84
5-6	--	--	--	--
6-7	8.0	1.0	15	75
7-8	8.0	1.0	15	84
8-9	8.0	1.0	15	81
9-10	7.9	.9	17	99
Core 9-D (corral):				
0-0.5	5.6	--	--	--
0.5-.7	--	--	--	--
0.7-1	7.5	7.0	120	1,100
1-1.5	7.7	4.0	70	480
1.5-2	8.0	5.5	86	500

Contd.

Table 2.--Water-soluble organic carbon, pH, and electrical conductivity of saturated paste extracts of 12 samples from corrals and irrigated fields--Continued

Core and depth (feet)	pH	Electrical conductivity	Carbon	
			Dry-wt. basis	In soil solution
		Mmho/cm.	p.p.m.	p.p.m.
Core 9-D (contd.)				
2-3	--	--	--	--
3-4	8.4	3.0	21	130
4-5	8.2	2.1	17	130
5-6	8.0	1.8	29	160
6-7	8.1	1.7	20	120
7-8	8.2	1.5	17	90
8-9	8.0	1.4	22	130
9-10	7.9	1.5	20	120
10-11	8.0	1.2	9	50
Core 9-H (corral):				
0.3-0.5	6.9	15+	1,300	12,000
0.5-1	7.4	15.0	290	2,900
1-1.5	7.5	8.3	74	760
1.5-2	7.6	6.0	36	310
2-3	--	--	--	--
3-4	7.3	3.6	76	690
4-5	7.4	4.2	41	370
5-6	7.4	4.4	60	410
6-7	7.2	4.1	67	400
7-8	7.3	4.3	53	310
8-9	--	--	--	--
9-10	7.2	3.7	50	250
10-11	7.3	3.4	44	200
11-12	7.2	2.0	26	130
12-13	7.4	1.1	11	170
13-14	--	--	--	--
14-15	7.4	1.7	44	1,500
15-16	7.5	.8	9	100
16-17	7.6	3.2	39	330
17-18	7.7	1.2	7	60
18-19	7.4	1.2	7	50

Contd.

Table 2.--Water-soluble organic carbon, pH, and electrical conductivity of saturated paste extracts of 12 samples from corrals and irrigated fields--Continued

Core and depth (feet)	pH	Electrical conductivity	Carbon	
			Dry-wt. basis	In soil solution
		Mmho/cm.	p.p.m.	p.p.m.
Core 16-B (corral):				
0.3-0.5	7.5	15+	640	2,900
0.5-1	7.5	5.4	270	1,100
1-1.5	7.7	4.5	100	410
1.5-2	7.8	4.8	76	390
2-3	--	--	--	--
3-4	7.8	3.0	41	180
4-5	7.7	4.0	71	790
5-6	--	--	--	--
6-7	8.1	1.5	19	400
7-8	7.9	1.9	13	92
8-9	7.8	3.8	40	180
9-10	7.8	3.2	25	170
10-11	7.4	5.0	25	150
11-12	7.3	4.4	19	100
12-13	7.6	2.4	14	210
13-14	7.7	2.8	29	170
14-15	7.8	2.6	13	210
15-16	7.5	3.6	18	120
16-17	7.7	2.4	14	240
17-18	7.7	1.7	8	200
18-19	7.9	2.4	11	320
19-20	7.8	2.9	20	290
20-21	7.9	2.3	20	290
21-22	7.9	1.3	8	200
22-23	7.9	1.4	8	200
23-24	--	--	--	--
24-25	8.2	1.6	9	200
25-26	8.2	.9	5	200
26-27	8.3	.6	4	200
27-28	8.2	.8	7	300
28-29	8.2	.9	4	100
29-30	8.0	.5	--	--

Contd.

Table 2.--Water-soluble organic carbon, pH, and electrical conductivity of saturated paste extracts of 12 samples from corrals and irrigated fields--Continued

Core and depth (feet)	pH	Electrical conductivity	Carbon	
			Dry-wt. basis	In soil solution
		Mmho/cm.	p.p.m.	p.p.m.
Core 16-B (contd.)				
30-31	7.8	0.6	4	200
31-32	7.7	.8	4	80
32-33	--	--	--	--
33-34	7.8	2.5	7	40
34-35	7.8	2.2	5	30
Core 16-E (irrigated field):				
0-0.5	7.3	1.0	140	1,100
0.5-1	7.2	.8	110	670
1-1.5	7.5	1.7	94	480
1.5-2	7.8	1.4	72	560
2-3	7.8	2.0	23	180
3-4	7.8	2.1	17	110
4-5	7.4	2.2	36	180
5-6	7.7	1.6	16	270
6-7	7.8	1.8	14	160
7-8	7.7	1.5	18	210
8-9	7.8	3.0	17	100
9-10	7.7	1.8	9	100
10-11	7.5	2.2	17	100
11-12	7.7	2.1	11	49
12-13	7.9	1.7	13	63
13-14	7.9	1.5	8	50
14-15	8.0	1.4	9	70
15-16	8.1	1.2	9	60
16-17	8.1	.9	4	60
17-18	7.8	.6	6	90
18-19	7.7	.3	8	100
19-20	7.8	1.5	5	30
20-21	7.4	1.3	22	72
21-22	7.5	1.4	13	41

Contd.

Table 2.--Water-soluble organic carbon, pH, and electrical conductivity of saturated paste extracts of 12 samples from corrals and irrigated fields--Continued

Core and depth(feet)	pH	Electrical conductivity	Carbon	
			Dry-wt. basis	In soil solution
		Mmho/cm.	p.p.m.	p.p.m.
Core 16-E (contd.)				
22-23	7.9	1.4	6	30
23-24	7.9	1.1	14	100
24-25	7.9	1.1	2	20
25-26	8.0	.6	4	90
26-27	8.4	0.6	2	40
27-28	8.0	.5	1	20
28-29	8.0	.6	3	300
29-30	8.3	.4	3	90
30-31	7.9	.4	3	100
31-32	8.1	.7	8	300
32-33	8.2	1.2	7	80
33-34	7.9	1.4	8	50
34-35	8.3	2.2	3	20
Core 16-F (irrigated field):				
0-0.5	7.3	1.1	110	740
0.5-1	7.3	1.1	78	460
1-1.5	7.5	1.2	66	290
1.5-2	8.0	.9	38	160
2-3	--	--	--	--
3-4	7.9	2.6	15	54
4-5	7.9	2.6	32	130
5-6	--	--	--	--
6-7	7.6	1.9	--	--
7-8	8.0	1.1	6	100
8-9	--	--	--	--
9-10	7.8	1.5	8	30
10-11	7.6	.8	11	63
11-12	7.5	1.5	19	92
12-13	7.5	1.7	18	68
13-14	8.1	1.2	25	460

Contd.

Table 2.--Water-soluble organic carbon, pH, and electrical conductivity of saturated paste extracts of 12 samples from corrals and irrigated fields--Continued

Core and depth (feet)	pH	Electrical conductivity	Carbon	
			Dry-wt. basis	In soil solution
		Mmho/cm.	p.p.m.	p.p.m.
Core 16-F (contd.)				
14-15	8.0	1.2	6	50
15-16	7.9	1.1	5	60
16-17	7.9	1.4	5	40
17-18	8.0	1.6	4	40
18-19	7.9	.5	2	80
19-20	8.2	1.0	3	50
20-21	7.9	.7	4	100
21-22	8.2	.3	4	100
22-23	8.0	0.7	4	100
23-24	7.9	.7	6	300
24-25	7.9	.5	3	100
25-26	7.8	.4	2	100
26-27	7.6	1.2	13	240
27-28	7.8	.9	5	100
28-29	7.9	.7	4	100
29-30	8.3	.6	2	60
30-31	8.4	1.7	4	20
31-32	8.2	2.2	6	30
32-33	8.3	2.2	7	40

Microbiological Determinations

Total bacterial count

Two aspects of the total bacterial counts are of interest. One is the great variability in counts on the individual samples in the deeper profile of a given core. Such variability belies the commonly held belief that microbial activity is uniformly low in the soil profile below the root zone. A second observation of interest was that for approximately half the core samples examined, there was a distinct bulge in the total count at or immediately above the water table. Such high total bacterial counts are apparent for the bottom samples of cores 16-B and 16-D in table 3. This table also shows that, in general, a higher bacterial population occurred in the soil profile beneath the feedlot than in that beneath the field crop. This difference is particularly striking for the bottom halves (the 15- to 35-foot depths) of the two profiles.

Nitrifying bacteria

It was expected that a higher amount of nitrifiable nitrogen in the feedlots would be accompanied by distinctly higher numbers of nitrifying bacteria under such sites. Table 3, however, shows the number of nitrifiers to be appreciable only in the surface foot of the irrigated cropland (core 16-D). Beneath this surface foot, only negligible numbers of nitrifiers were found scattered down through the profile. Unfortunately, one cannot say whether these scattered nitrifiers are truly indigenous at these depths, or whether they merely reflect downward contamination from the surface flora during the drilling operation.

Nitrifiers were entirely absent in the feedlot core 16-B below the surface 2 feet; they were only sparsely present near the surface. Determinations made on other core samples indicate that the nitrifiers occur quite erratically in core samples generally. Table 4 presents populations of nitrifiers as determined for six other core samples. Inspection of this table in conjunction with the nitrifier counts shown in table 3 cautions against trying to distinguish between feedlot and cropland sites on the basis of their nitrifying populations.

Table 3.--Counts of nitrifying and total bacteria per gram for samples from cores 16-B and 16-C

Depth (feet)	Nitrifying bacteria		Total bacteria	
	Core 16-B[1]	Core 16-D[2]	Core 16-B[1]	Core 16-D[2]
			Thousands	Thousands
0-0.5	0	540,000	47,000	52,000
0.5	130	540,000	27,000	31,000
1-1.5	8	79	17,500	7,400
1.5-2	0	79	10,000	4,300
2-3	0	33	2,410	1,190
3-4	0	33	1,890	1,110
4-5	0	1	3,500	217
5-6	0	23	176	430
6-7	0	8	670	427
7-8	0	8	980	1,040
8-9	0	0	1,270	720
9-10	0	1	54	1,420
10-11	0	5	109	820
11-12	0	33	490	754
12-13	0	2	76	46
13-14	0	0	155	13
14-15	0	23	3,280	5,700
15-16	0	2	4,220	1,610
16-17	0	2	11,000	913
17-18	0	2	65	930
18-19	0	0	101	91
19-20	0	23	1,870	104
20-21	0	13	69	121
21-22	0	7	173	330
22-23	0	7	153	60
23-24	0	0	243	29
24-25	0	0	980	109
25-26	0	2	550	123
26-27	0	2	670	7
27-28	0	0	570	13
28-29	0	0	420	43
29-30	0	0	300	16
30-31	0	0	62	34
31-32	0	0	650	3
32-33	0	0	1,890	201
33-34	0	0	1,310	99
34-35	0	33	1,370	2,020

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[1] Under feedlot.

[2] Under irrigated corn.

Table 4.--Nitrifying bacteria (Nitrosomonas) per gram in selected core samples of moist soil

Under feedlots at sites 5-B and 11-I

Core 5-B		Core 11-I	
Depth (ft.)	Per gram	Depth (ft.)	Per gram
0-.5	4,500	[1] 0-2	13,200
0.5-1	2,000	1-1.5	13
1-1.5	2,500	4-5	4
4-5	0	5-6	2
11-12	3,500	9-10	2
15-16	490	17-18	0
19-20	230	19-20	7
23-24	20		

Under irrigated alfalfa at sites 2-D and 15-B

Core 2-D	
0-0.5	14,000
1.5-2	4,900
3-4	450
11-12	0
16-17	0
21-22	0

Core 15-B	
0-0.5	24,000
2-3	3,500
6-7	240
7-8	7
11-12	24
13-14	240
15-16	7
17-18	0
19-20	0
20-21	0
21-22	0
22-23	23
24-25	79
27-28	0
29-30	0
31-32	1
34-35	14
37-38	0
40-41	0
44-45	0
47-48	49
50-51	0
52-53	1
54-55	0
57-58	0

Contd.

[1] Inches.

Table 4.--Nitrifying bacteria (Nitrosomonas) per gram in selected core samples of moist soil--Continued

Under irrigated corn at sites 12-C and 14-C			
Core 12-C		Core 14-C	
Depth (ft.)	Per gram	Depth (ft.)	Per gram
0-.5	24,000	0-0.5	160,000
2-3	33	0.5-1	490
4-5	49	1-1.5	330
7-8	23	1.5-2	100
11-12	0	3-4	9
15-16	0	11-12	22
19-20	2	21-22	8
23-24	2	29-30	49
		35-36	13
		41-42	9
		47-48	17
		53-54	79

Sporulating bacteria

Numerous individual core samples were streaked directly on pre-poured agar plates in order to scan macroscopically the colony types that might develop. In the course of this work, sporeforming bacteria were consistently observed in the upper profile but only rarely in the deeper profile. Quantitative study of the sporeforming population was undertaken on selected core samples; the data obtained are presented in table 5. These data substantiate the macroscopic observations that, at or near the soil surface, the sporulating bacteria constitute a larger percentage of the total bacterial flora than they do in the deeper profile. If observations of this type can be confirmed and extended, it is probable that methodology can be developed to the point that it will be helpful in detecting and interpreting microbial contaminations of the deeper profile or of ground waters.

Table 5.--Sporulating and total bacteria per gram for selected core samples

Core and depth (ft.)	A. Total bacteria	B. Sporulating bacilli	B/A x 100
	Thousands	Thousands	Percent sporulating
Core 9-F (corral):			
0.5-1	10,000	2,500	25.0
1.5-2	1,000	40	4.0
3-4	46	7.9	17.2
6-7	13	.1	.8
9-10	11	.8	7.3
11-12	7	.26	3.7
13-14	3	.1	3.3
Core 14-C (nonirrigated cultivated field):			
0-0.5	11,600	1,500	12.9
0.5-1	3,300	400	12.1
1-1.5	4,300	500	11.6
1.5-2	3,700	200	5.4
3-4	780	17.3	2.2
11-12	7	.26	3.7
21-22	14	.35	2.5
29-30	19	.38	2.0
35-36	25	1.19	4.8
41-42	56	.58	1.0
47-48	48	.40	.8
53-54	8	.50	6.3
Core 18-B (nonirrigated sod):			
4-5	770	107	13.9
10-11	31	3.8	12.2
16-17	9.2	.37	4.0
Core 18-C (nonirrigated cultivated field):			
4-5	1,180	65.4	5.5
10-11	253	5.6	2.2
16-17	58	1.16	2.0

Chemical Analyses of Water Samples

Analyses for the water samples are given in table 6. In many cases, there was insufficient sample to run all of the analyses. The water samples were obtained from the core holes at the first depth that any water was available for collection. Therefore, the water is not necessarily representative of the water in a domestic well at the same site. This fact should be kept in mind when interpreting the results of the analyses. The results should, however, give some indication as to the constituents moving through the soil to the ground water.

Table 6.--Chemical analyses of water samples taken in the middle South Platte Valley of Colorado, 1966

Irrigated Alfalfa Fields

Core No.	NO_3^-	NO_2^-	NH_4^+	Eh	pH	Electrical Conductivity	Organic C	Inorg. P	Org. P
	p.p.m.	p.p.m.	p.p.m.	Mv.		Mmhos/cm.	p.p.m.	p.p.m.	p.p.m.
1-C	5.4	0.04	0.	320	8.3	1.0	7	0.02	0.02
1-D	1.0	.03	.1	--	8.2	.4	5	.04	0
1-E	7.0	.00	.2	500	--	--	10	.02	.03
1-F	3.3	.03	0	540	9.1	.5	--	--	--
2-D	44	2.3	.7	-340	8.3	1.4	29	0	.14
5-D	5.5	.07	.1	320	8.1	1.0	14	.06	.22
6-E	8.8	.83	.4	-10	--	--	13	0	1.1
6-F	9.8	.21	.9	360	8.2	1.5	0	--	--
11-J	7.9	.09	.1	530	--	--	--	--	--
13-C	10	.15	--	-250	--	--	--	--	--
16-E	1.9	1.0	1.4	350	8.4	3.1	13	0	.05

Contd.

Table 6.--Chemical analyses of water samples taken in the middle South Platte Valley of Colorado, 1966--Continued

Irrigated Fields (Other Than Alfalfa)

Core No.	NO_3^-	NO_2^-	NH_4^+	Eh	pH	Electrical Conductivity	Organic C	Inorg. P	Org. P
	p.p.m.	p.p.m.	p.p.m.	Mv.		Mmhos/cm.	p.p.m.	p.p.m.	p.p.m
2-E	14	0.06	0.1	370	8.1	0.8	5	0.10	0.16
2-F	36	.04	.1	360	8.3	1.0	27	.02	.05
3-C	.7	0	0	280	9.1	.5	5	.04	.03
3-E	.9	.01	0	400	8.0	2.8	10	.02	.35
5-C	3.0	.27	0	-50	8.3	.9	26	0	.78
7-B	.1	.17	0	300	8.1	1.5	18	.01	.05
9-B	14	.24	.1	360	8.3	2.4	8	0	.06
9-C	31	.09	.1	360	8.3	1.7	12	.01	.03
9-J	8.5	0	0	430	8.0	1.2	9	.03	.01
11-C	8.8	1.1	.2	420	--	--	--	--	--
11-B	1.4	.66	.3	350	--	--	--	--	--
11-A	7.2	1.3	.1	150	--	--	--	--	--
11-E	18	.15	.1	520	--	--	--	--	--
11-F	15	.15	0	430	--	--	--	--	--
12-C	0	.18	0	150	--	--	--	--	--
12-D	10	.32	--	-330	--	--	--	--	--
14-G	10	4.5	0	380	--	--	--	--	--
16-D	18	.06	.4	430	8.3	2.6	26	0	.05
16-F	17	.10	1.1	300	8.1	3.0	17	0	.04

Corrals

Core No.	NO_3^-	NO_2^-	NH_4^+	Eh	pH	Electrical Conductivity	Organic C	Inorg. P	Org. P
1-A	4.7	0.04	2.2	330	--	--	11	0.01	--
1-B	2.3	.04	.1	330	--	--	10	.01	--
2-B	29	2.5	0	420	8.5	1.3	36	--	--
2-C	25	1.7	0	320	8.9	1.1	100	.05	.15
3-A	.1	.01	2.1	460	7.8	.7	40	2.90	.02
3-B	0	0	1.7	200	8.4	.5	6	.03	.04
5-A	8.8	.21	.1	390	8.3	1.1	55	.20	2.4
5-B	8.0	.26	.1	40	7.7	1.2	23	.07	.48
6-C	16	.28	2.0	380	8.2	1.7	19	.01	.02
6-D	11	.23	.8	420	--	--	--	--	--
7-D	13	.10	.5	250	--	--	--	--	--
7-E	8.6	.09	5.1	-340	8.1	1.8	130	.15	.10
8-E	61	.10	.1	440	8.0	5.5	40	.01	.03
9-D	8.5	.20	.8	260	--	--	--	--	--

Contd.

Table 6.--Chemical analyses of water samples taken in the middle South Platte Valley of Colorado, 1966--Continued

Core No.	NO_3^-	NO_2^-	NH_4^+	Eh	pH	Electrical Conductivity	Organic C	Inorg. P	Org. P
Corrals (con.)									
	p.p.m.	p.p.m.	p.p.m.	Mv.		Mmhos/cm.	p.p.m.	p.p.m.	p.p.m.
9-E	21	5.7	5.8	340	8.1	2.0	90	.14	.08
9-F	18	.04	5.7	-310	8.2	2.4	130	--	--
9-G	24	.12	11	--	8.1	2.7	120	0	.05
9-H	41	.07	2.9	-30	--	--	--	--	--
10-G	24	2.9	2.4	270	--	--	--	--	--
10-F	14	.02	0	500	--	--	--	--	--
10-D	5.3	.07	22	340	7.9	2.4	300	--	--
10-C	0	.03	13	190	8.1	1.8	54	0	.06
11-G	11	.51	0	460	--	--	--	--	--
11-H	8.1	.88	.5	420	--	--	--	--	--
11-I	9.0	.35	.3	430	--	--	--	--	--
11-J	7.9	.09	.1	530	--	--	--	--	--
12-A	16	.30	--	80	--	--	--	--	--
12-B	0	1.3	--	50	--	--	--	--	--
13-A	8.8	.78	--	250	8.1	2.0	37	--	--
13-B	22	3.7	--	130	--	--	--	--	--
16-A	14	.55	2.6	40	8.3	2.8	23	--	--
16-B	1.1	.53	38	100	7.8	4.8	170	0	1.3
16-C	.5	5.9	10	180	8.3	3.2	60	0	.22
Nonirrigated Fields (sod)									
2-A	0.1	0.03	0	400	8.5	0.6	12	--	--
6-G	10	.09	0	200	--	--	--	--	--
7-G	17	.04	.1	350	8.3	1.5	31	0.01	0.01
7-H	19	.48	1.0	-320	8.2	1.5	51	--	--
9-A	10	.22	.3	-330	8.3	1.0	23	.06	.85
10-B	16	.07	0	400	--	--	7	0	1.9
10-A	18	.26	.6	450	--	--	--	--	--
14-B	2.2	--	.3	370	--	--	--	--	--
Nonirrigated Fields (Cultivated)									
5-F	9.5	.09	--	-110	--	--	--	--	--
5-E	7.0	.06	0	330	8.1	.8	24	.15	2.2
11-D	7.9	.03	0	410	--	--	--	--	--
14-C	5.0	.23	.2	-380	--	--	--	--	--

Organic carbon and ammonium show the largest differences between waters collected under corrals and irrigated fields. The average concentration of ammonium-N of the waters from beneath 28 irrigated fields was 0.2 p.p.m., and only two samples contained as much as 1 p.p.m. On the other hand, waters from beneath 29 corrals averaged 4.5 p.p.m. N as ammonium. Fifteen of these contained greater than 1 p.p.m., seven of which were above 5 p.p.m. The highest concentration of ammonium-N found was 38 p.p.m. Similar differences were found in the organic carbon concentrations. The average organic carbon concentration for samples from under irrigated fields was 14 p.p.m., and the highest concentration found was 29 p.p.m. For waters under corrals, the average value was 73 p.p.m., and 13 of the 20 samples contained more than 300 p.p.m., and 6 of the 13 contained more than 100 p.p.m. The highest concentration of organic carbon found in the water samples was 30 p.p.m. In general, there was a correlation between the ammonium and carbon found in the water. A sample with a high ammonium-N concentration usually contained a substantial amount of organic carbon. The significance of this contamination cannot be assessed from these studies but points to an area where additional studies are needed. There is a possibility that the N measured as ammonium was actually present as some organic compound that yielded ammonium during distillation, although the procedure (1) used is generally believed to measure only ammonium-N. The extent that this ammonium may later be nitrified cannot be evaluated from this study.

The redox potential (Eh) varied for samples from both corrals and irrigated fields, although the average value for the corral samples (246 mv.) was lower than the average for the irrigated field samples (273 mv.). There was no close relationship between Eh and the NO_3^--N content of the waters. Some relationship, however, was apparent between Eh and the amount of organic C in the water, as most samples high in C had a low Eh.

Nitrate and nitrite were found in most of the waters analyzed, and in many cases, the amounts were high. No particular land use group of samples, however, was noticeably higher in these compounds.

Denitrification

The nitrate distribution data showed that, in general, corrals contained little nitrate in the top few inches, high amounts for the next several feet, and then rapidly decreasing amounts at the deeper depths. The reason for the lack of nitrate often found at the shallow depth is probably the lack of oxygen, indicated by the low redox values measured in many of the cores. When a low redox potential existed, no nitrate was found. On the other hand, since there was almost always a high level of ammonium present in the corrals, substantial amounts of nitrate were found when the redox potential was high enough to favor nitrate accumulation. This relationship is illustrated in figure 6, which shows the nitrate present in corral samples for the 0.5- to 5-foot depths plotted against the redox potential. When the redox potential was below 320 to 340 mv., there was seldom any nitrate present. High amounts of nitrate were generally found when the redox potential was higher than 340 mv. The samples for depths shallower than 0.5 foot were not plotted because many of these samples were very dry and the redox potentials obtained are therefore questionable. The redox potential of about 330 mv. found necessary for nitrate accumulation agrees closely with laboratory data previously reported. Pearsall and Mortimer (9), and Patrick (7), reported values of 320 and 338 mv., respectively, as the critical redox potential necessary for nitrate accumulation.

With respect to the rapid decrease, and in some cases, the complete absence of nitrate often found at the deeper depths under corrals, the question arose as to whether substantial denitrification was occurring at these deeper depths. Cores 16-B and 16-D were chosen to conduct further investigations to obtain data that would help to answer this question. Cores 16-B and 16-D represented a feedlot and irrigated cornfield, respectively, and were obtained from the same soil area. The number of bacteria and concentration of salts were determined and these data, along with nitrate, nitrite, and water percentages previously reported, are shown graphically (fig. 7).

There was a higher concentration of salts under the corral at all comparable depths than under the irrigated corn. In both cores, however, there was a direct relationship between the conductivity of the saturated extracts and the water percentage present at the time of sampling. The water sample obtained from under the corral contained high amounts of ammonium and carbon (table 6). These findings strongly suggest that water is moving through the soil and into the water table. The hydraulic conductivity values found further support this conclusion.

A close relationship is also evident between the electrical conductivity and the nitrate found in the core from the irrigated corn field, but this relationship does not hold for the corral core (fig. 7). Since the evidence indicates that water is moving through the soil, the scarcity of nitrate found in the corral core suggests that denitrification is occurring.

The bacteria and nitrite data shown in figure 7 further indicate that denitrification is occurring under the corrals at deep depths. There were considerably larger populations of bacteria in the corral core, especially at the deeper depths. Below 15 feet, there was about 10 times more bacteria

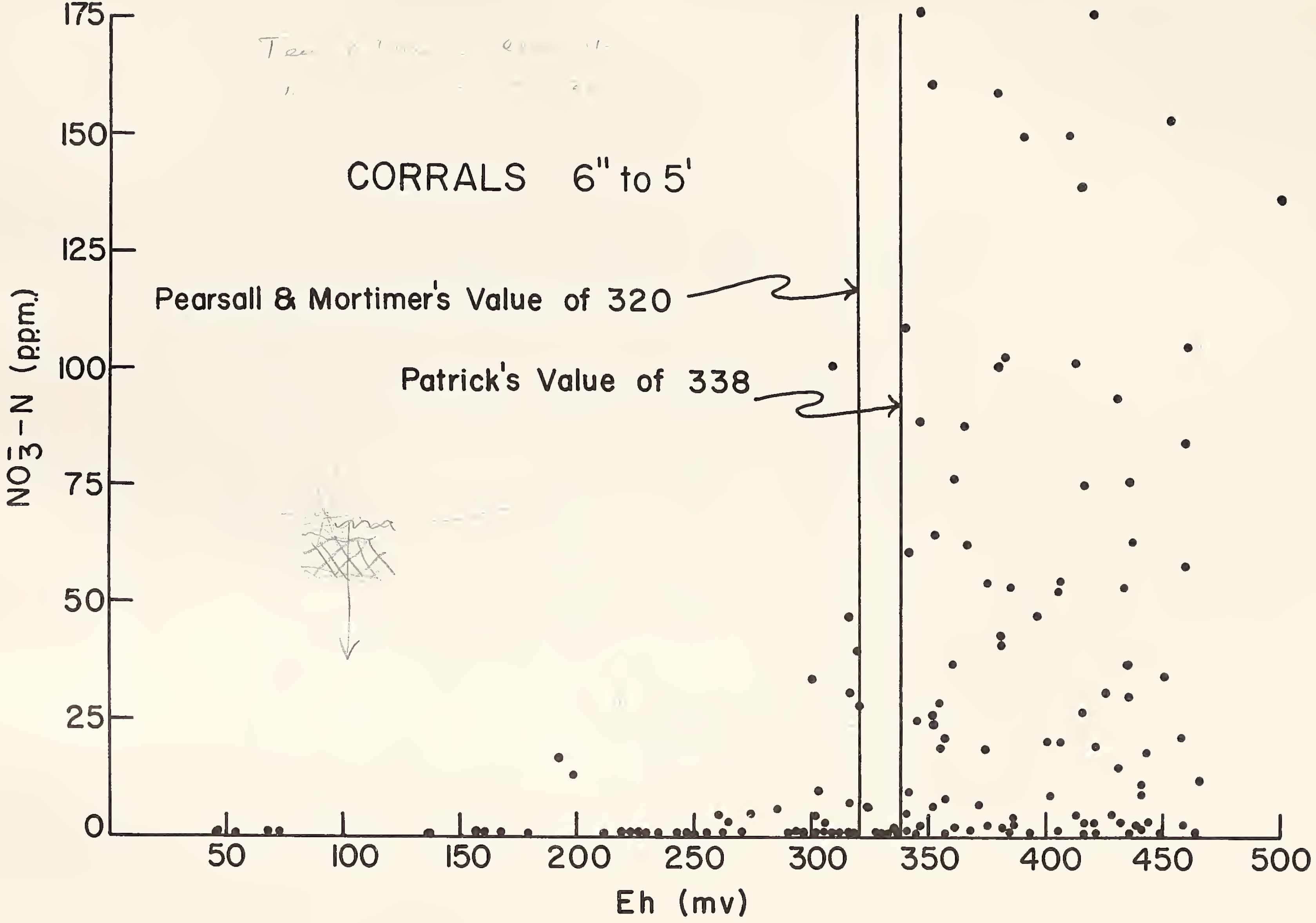
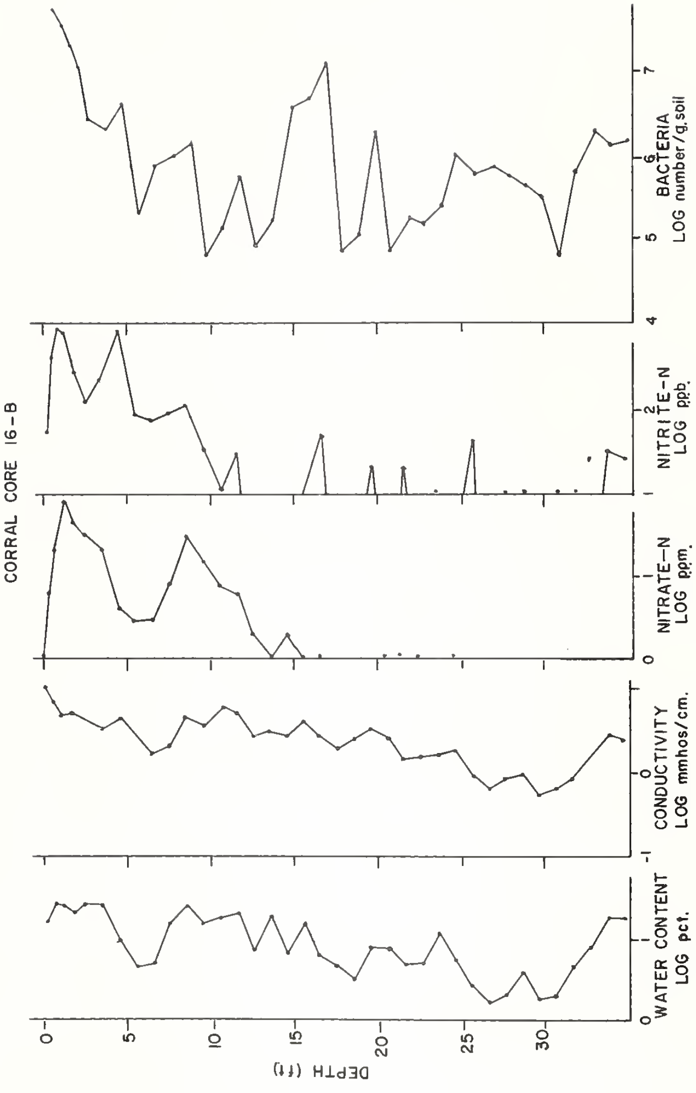


Figure 6.--Relationship between the redox potential measurements of the samples and the nitrate present in corrals.



CORRAL CORE 16-B

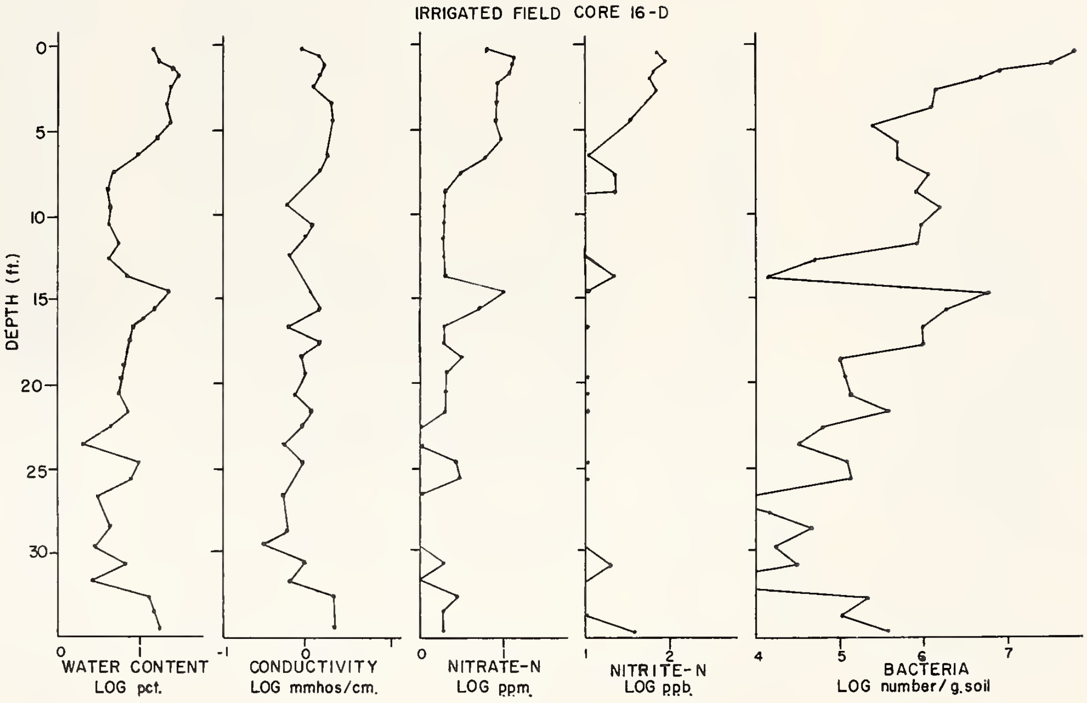


Figure 7.--Water percentages, nitrate, nitrite, conductivities, and bacterial counts at various depths for cores 16-B (corral) and 16-D (irrigated field).

under the corral as compared to those present in the core from the irrigated field. This increase is undoubtedly caused by a high carbon supply under the corral. Data presented earlier (section on pH, total salts, and water soluble carbon) showed that there are higher amounts of water-soluble carbon under corrals than under irrigated fields. The nitrite data for the corral core are plotted in figure 7, and they show concentration peaks corresponding to the peaks in bacteria population.

Although the quantity of nitrite present is rather small, the relationship to bacteria counts and the absence of nitrate does suggest that denitrification is occurring. The data for the irrigated field show much smaller concentrations of nitrite and numbers of bacteria, and in this case, nitrate is present at all depths in the profile. These data are only from one site, and cannot necessarily be interpreted as typical. However, denitrification at all depths under corrals must be considered in interpreting nitrate distribution data.

Hydraulic Conductivity Measurements

The number of samples having conductivities in the indicated ranges are shown in figure 7. The mean conductivities were about 2 to 3 cm.^{3} of water per square centimeters per year.

An estimate of the average hydraulic conductivity also furnishes a reasonable estimate of the amount of gravitational movement of water if the only force acting to move the water is gravity. A gravity gradient is a reasonable assumption if the sample is taken from below the influence of the root zone and is twice as far above the water table as the suction head in the sample; that is, if the tension in the sample is 100 cm. of water, the sample will have to be at least 2 meters above the water table for a gravitational gradient to be assumed. At a few sites the zone of root influence overlapped the zone of water table influence, and it was not possible to assume just a gravitational gradient. All samples within 5 feet of the surface or within 10 feet of the water table were excluded from the gravitational water movement calculations. When more than one sample was in the zone where an approximately gravitational gradient could be assumed to exist, the average of all such samples in a given core was used as the best estimate of the gravitational water movement.

The curve labeled "cores" in figure 8 shows the number of cores having average estimated hydraulic conductivity values in each of the indicated ranges. The lack of cores with low conductivities is associated with the fact that most of the samples that had low conductivities were taken from the upper few feet of soil where they had been influenced by the roots which had extracted water from them.

The distribution of conductivities in the cores within the drylands of eastern Colorado is shown in figure 9 for the cultivated and sod areas. The estimated gravitational movement of water is essentially the same beneath the sod and the cultivated soils. The average rate of downward movement was about 2.5 cm. per year.

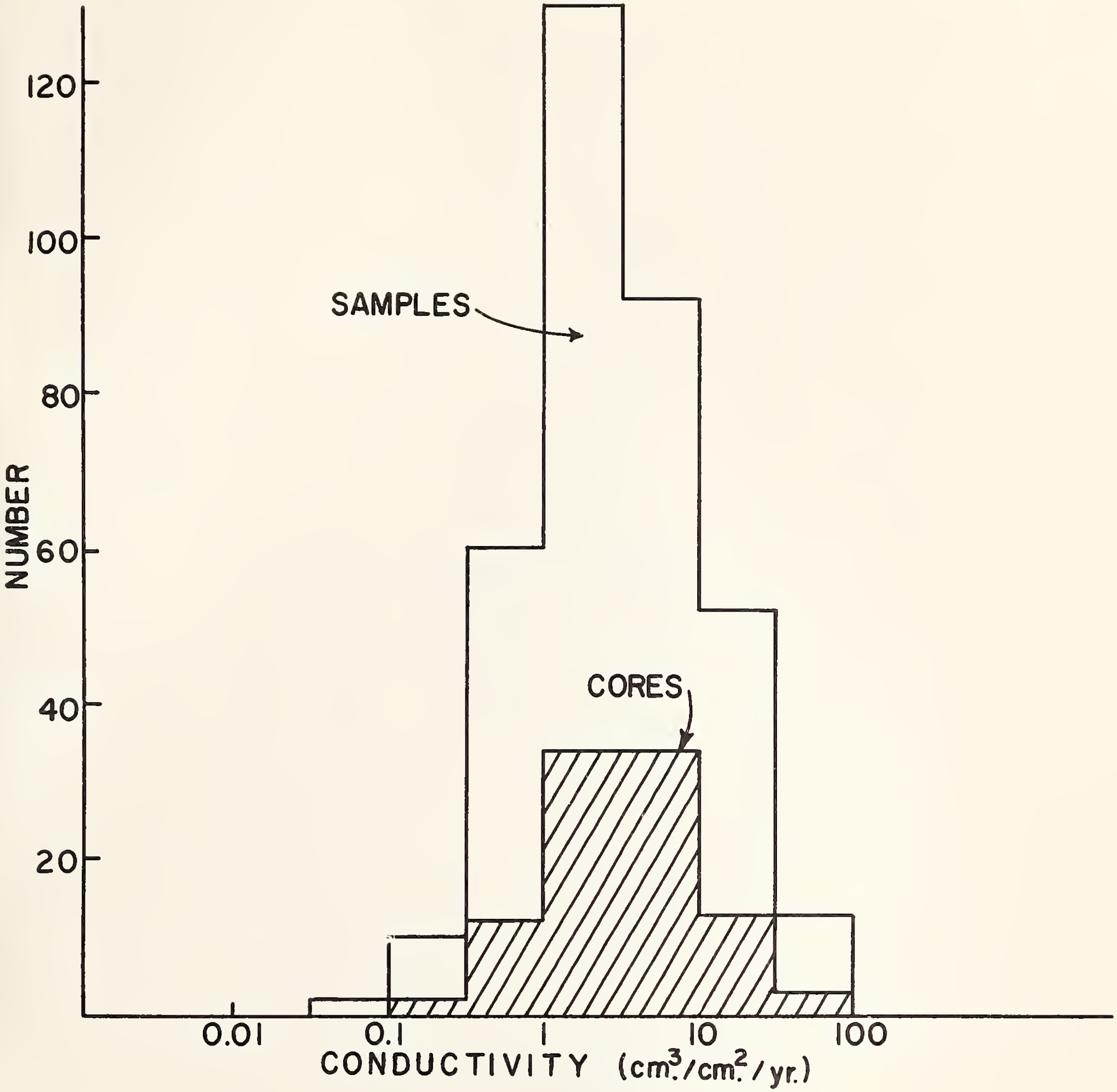


Figure 8.--Histogram showing the number of samples and cores with hydraulic conductivities in the indicated ranges.

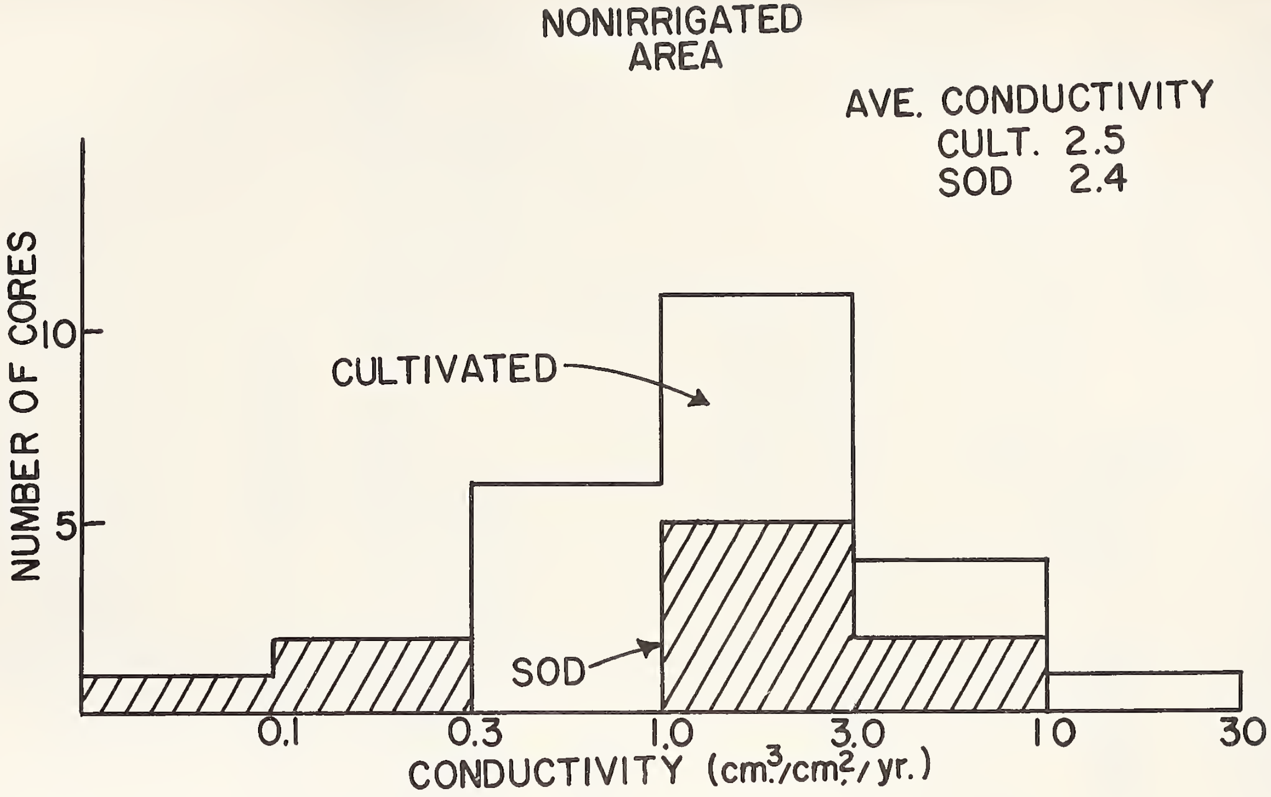


Figure 9.--Histogram showing the distribution of hydraulic conductivities for cores taken from nonirrigated areas.

The gravitational movement below the irrigated areas averaged about 9 cm. per year and was considerably greater than below dryland areas (fig. 10). It was slightly greater below those areas in alfalfa than below those irrigated areas that did not have alfalfa. This may be a reflection of the greater application of water to the areas in alfalfa. However, the difference is not statistically significant even at the 90-percent level of probability. The areas in alfalfa appeared to have a broader range of conductivities, which may reflect a greater degree of mismanagement of alfalfa (that is, over- or under-irrigated) than of the other crops.

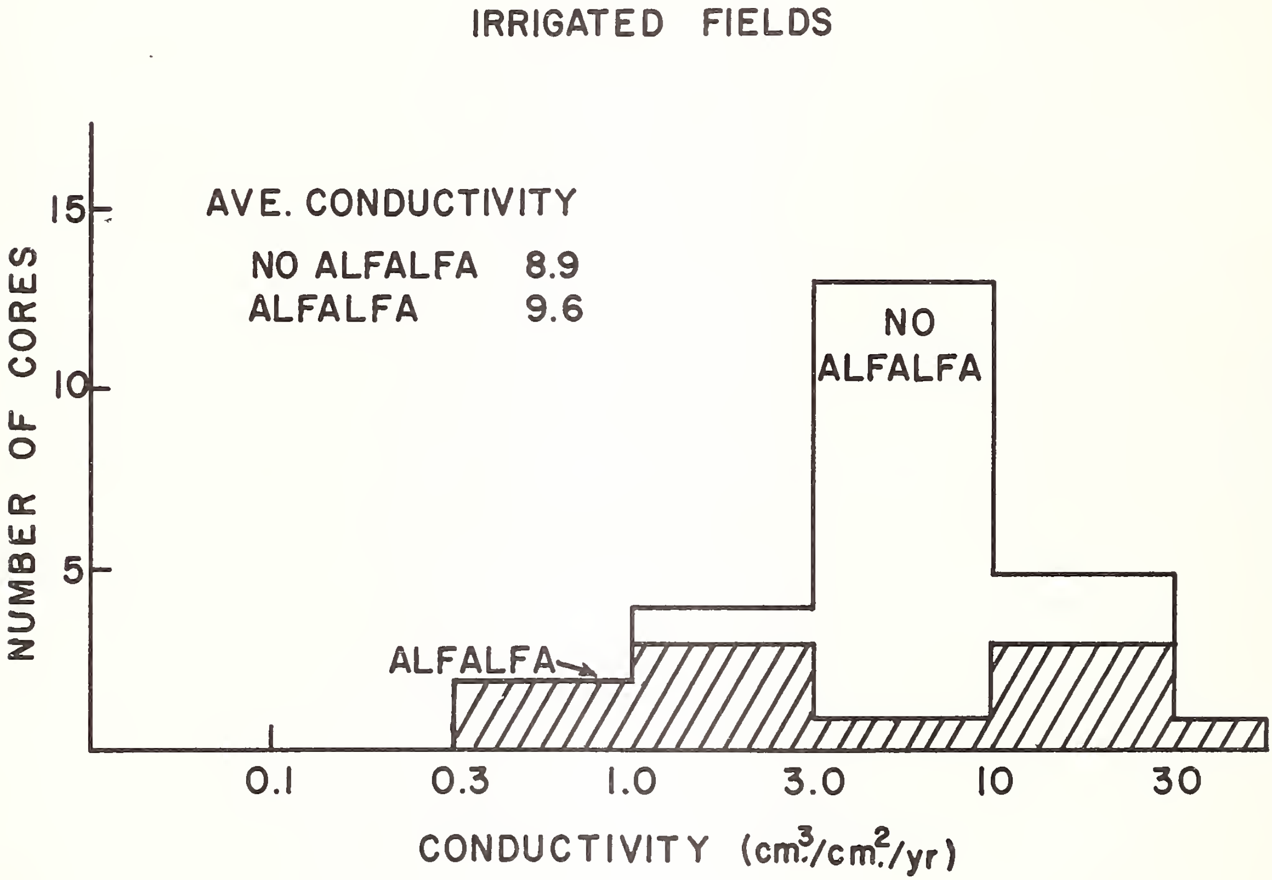


Figure 10.--Histogram showing the distribution of hydraulic conductivities for cores taken from irrigated fields.

In figure 11 the distribution of conductivities under feedlots is plotted along with a plot of the distribution under all cores. The gravitational movement below feedlots is about midway between the gravitational movement of water below dryland and irrigated areas.

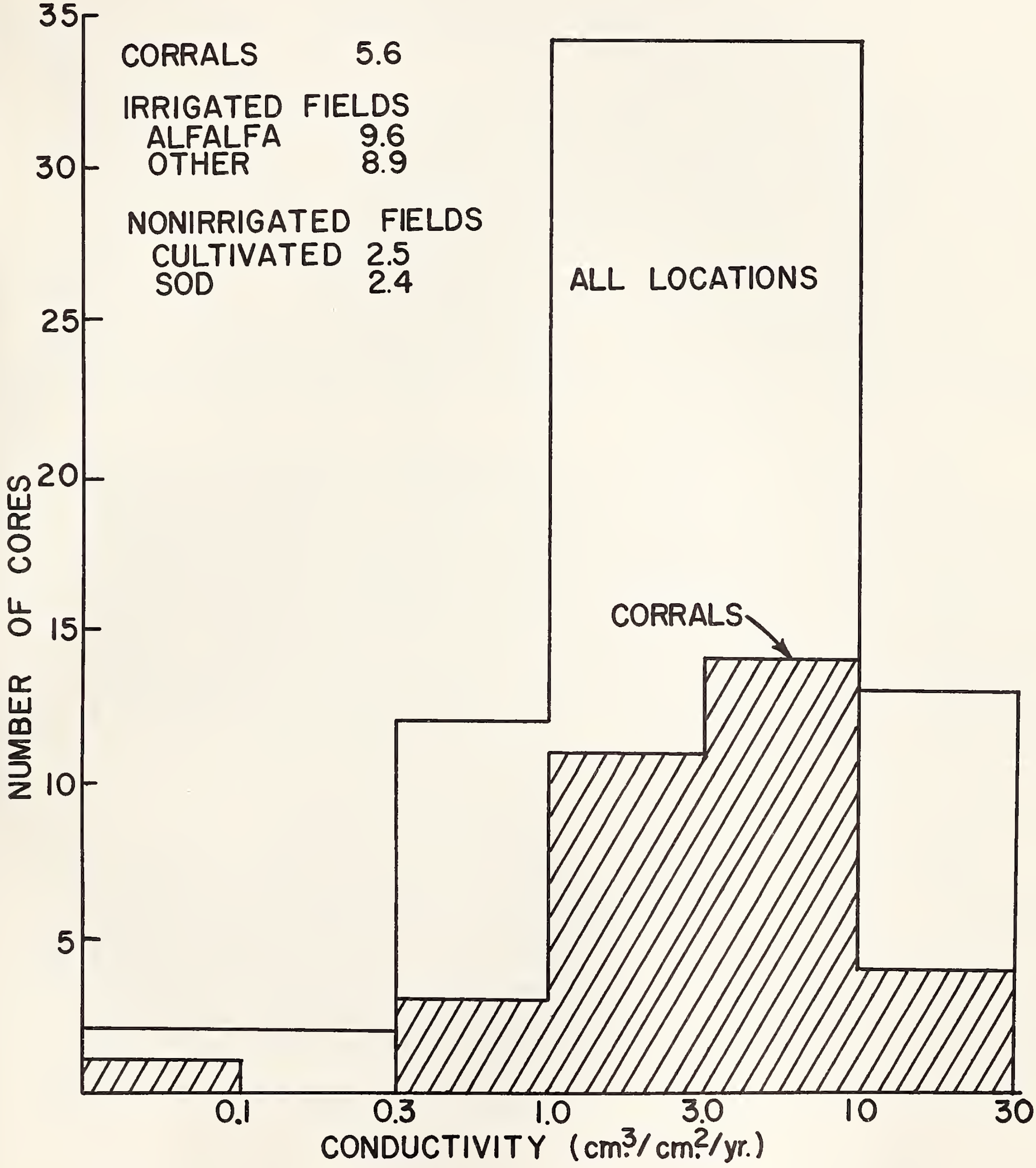


Figure 11.--Histogram showing the distribution of hydraulic conductivities for cores from corrals, as compared to those taken from other areas.

It should be noted that the actual downward displacement of water in a profile would be obtained by dividing the conductivity figures indicated in these graphs by the fractional volumetric moisture content of the soil. This fractional volumetric moisture content ranged from 0.03 in some of the drier and sandier soils to 0.25 in some of the finer textured and wetter soils. Even with this in mind, the rate of gravitational movement of water and any dissolved and unabsorbed contaminant down through the soil was always less than 4 feet per year and generally less than 15 inches per year. The question remaining to be answered is whether the time at which these samples were taken was such that the rates of movement can be considered as characteristic of the soil on a year-around basis. In the case of the dryland soils, the downward movement is so slow that seasonal variations should be negligible at depths below 10 feet from which most of these gravitational movement rates are obtained. On the other hand, in the irrigated areas it seems possible that during the previous irrigation season, rates might have been several times greater than those observed from samples taken in the spring of 1966 after the profile had a chance to drain much of the irrigation water accumulated during the previous season. Reported values, therefore, probably represent the minimum. Feedlots would probably have a more uniform rate of water application than the irrigated areas, and the estimates of gravitational movement of water and nitrate below these feedlots are probably closer to the real averages than were those in the irrigated areas.

Figure 12 shows the average water percentage distribution with depth of profiles from corrals (47), irrigated fields (41), dryland cropped fields (21), and dryland native grassland fields (17). Values from the alfalfa fields were not separated from those of other irrigated fields, because they were similar. There was a positive relationship between the water content for the profiles of the various land uses and the respective average hydraulic conductivities. As water percentages in the profiles increased, there was a corresponding increase in the hydraulic conductivity rates. The dryland profiles did, however, show an exception. Average hydraulic conductivity values were almost equal for the cultivated and native grass areas, while the average water percentages were higher under the cropped land.

Maps, Information, and Detailed Data for Individual Locations

Maps for individual locations, showing the sites where each core was taken during the period of April 26-August 8, 1966, are shown in figures 13 through 31. Tables 7 through 25 show the water percentages, hydraulic conductivities, nitrates, nitrites, and ammonium for all cores, and a summary of the significant findings for each location table. General information regarding the soils and management practices is presented along with the maps. Appreciation is expressed to the land owners and operators who aided this study by providing information and allowing sampling of their fields and corrals.

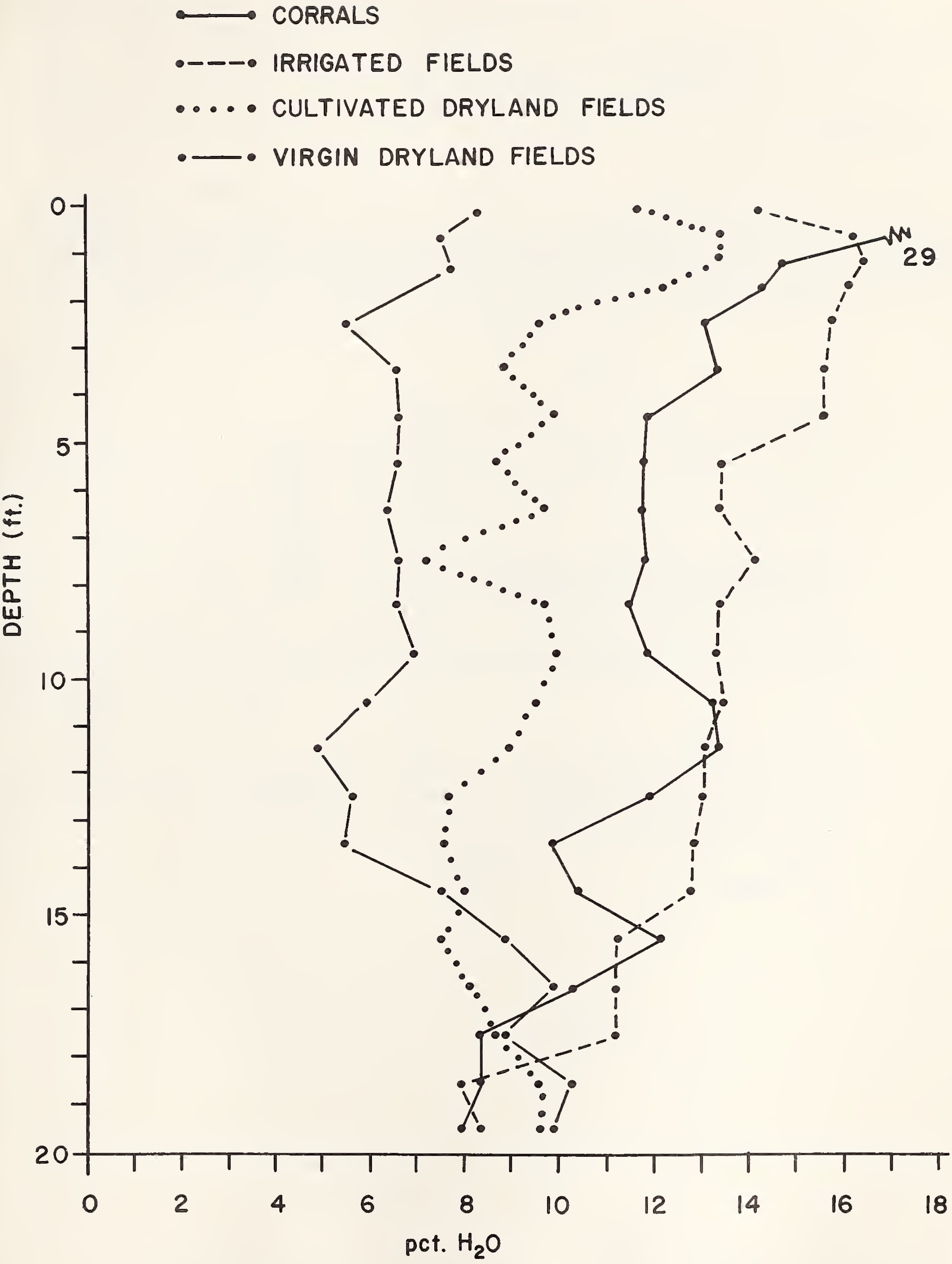


Figure 12.--Average water content with depth of profiles.

Location No. 1

General Location: 2 miles S. and 2 miles E. of Fort Collins, Colo.
(2 miles N. of Harmony School)

General Remarks:

Soils: Fort Collins Loam Slope: 0-1 pct.

Corrals: The corrals have been in use since about 1927 (fig. 13). They are currently used for 4 to 5 months during the year. Approximately 150 cattle are fed in the corrals. The manure is removed once a year and spread over the fields.

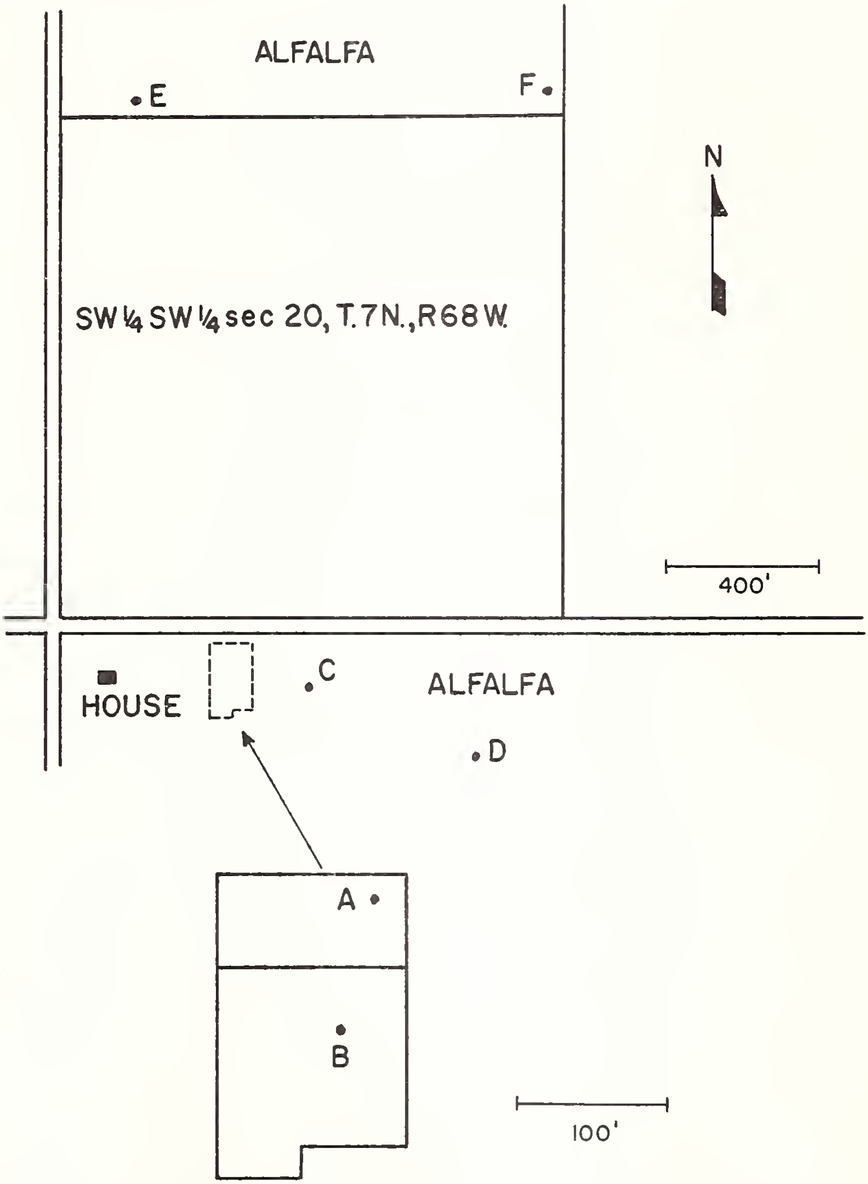


Figure 13.--Location 1 and core sites, near Fort Collins, Colo.

Irrigated Fields: The principal crops grown are alfalfa, corn, sugar beets, and small grains. The fields receive 20 tons of manure about once every 4 years. When corn or beets are grown, 100 pounds each of N and P_2O_5 per acre are also added. All cores from irrigated fields were taken from alfalfa fields. The area where cores 1-E and 1-F were taken was in its first year of alfalfa, cores 1-C and 1-D were taken from an area that was in its third successive year of alfalfa.

Water Quality: About 1957, the cattle in the corrals became sick. The veterinarian suggested drilling a new well farther from the corrals. The farmer does not know the results of the water analyses at that time. The newer well is used to water livestock but not for domestic purposes. The water table is at 12 to 15 feet during the winter, but rises to within 5 feet of the surface during the irrigation season.

Significant findings:

Cores 1-A and 1-B, taken from corrals, showed little or no nitrate present (table 7). The low nitrate level is probably caused by a low oxygen status, as indicated by the low Eh values for the top 2 to 3 feet of these cores. Previous studies (7, 90)have shown that nitrate is generally unstable in soil systems when the Eh value is lower than about 320 to 340 mv. At the 0.5-foot depth of core 1-B, there was 20 p.p.m. nitrite-N, which further suggests a low oxygen status. There were large amounts of ammonium-N near the surface of the cores, but the level decreased rapidly with depth. In core 1-A, however, there was a significant amount of ammonium-N at all depths, suggesting that some ammonium, or compounds yielding ammonium, was moving through the soil. The 2.2 p.p.m. of ammonium-N found in the water sample also supports this view.

The other cores at this location were obtained from alfalfa fields. Only small amounts of nitrate, nitrite, or ammonium were present in these cores.

Table 7.--Location 1: Chemical and physical analyses of cores and water samples taken near Fort Collins, Colo., 1966

Core, depth (ft.) and water sample	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 1-A (corral):							
0-0.1	M	36.9	--	390	0	0.00	2,000
0.1-0.3	SiCL	16.2	--	100	3	.48	570
0.3-0.5	SiCL	19.9	--	300	48	--	21
0.5-1	SiCL	20.2	--	320	31	--	13
1-1.5	SiCL	20.6	--	340	0	--	6
1.5-2	SiCL	21.0	--	340	1	--	14
2-3	SiCL	22.0	27	--	1	.04	16
3-4	SCL	18.1	--	360	1	--	10
4-5	SCL	17.7	--	350	1	--	10
5-6	SiCL	24.0	19	--	0	.00	5
6-7	C	22.8	--	400	1	--	14
7-8	C	21.9	--	420	0	--	6
8-9	C	17.0	5.7	--	1	--	1
9-10	C	16.7	--	420	0	--	19
10-11	CL	16.8	--	460	0	--	3
Water sample				330	4.7	.04	2.2
Core 1-B (corral):							
0-0.1	M	21.6	--	230	0	.09	1,100
0.1-0.3	SiCL	16.4	--	290	0	.05	570
0.3-0.5	SiCL	16.3	--	280	0	.16	--
0.5-1	SiCL	18.1	--	300	0	20.00	17
1-1.5	SiCL	18.5	--	310	0	.11	5
1.5-2	SiCL	19.1	--	310	0	.03	5
2-3	SiCL	20.6	7	--	0	.00	2
3-4	SiCL	28.5	--	340	0	.03	0
4-5	SCL	18.9	--	330	0	.02	2
5-6	SCL	16.9	--	--	0	.01	0
6-7	SiC	24.5	--	340	0	.01	2
7-8	C	20.8	--	390	1	.01	1
8-9	C	19.7	12	--	0	.01	5
9-10	C	21.3	--	370	1	.01	2

1/ See table 1 for texture symbols.

Contd.

Table 7.--Location 1: Chemical and physical analyses of cores and water samples taken near Fort Collins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 1-B (contd.):							
10-11	C	19.4	--	410	0	0.01	0
11-12	C	19.6	--	390	0	.01	0
12-13	SL	21.7	--	410	0	.01	2
Water sample				330	2.3	.04	.1
Core 1-C (irrigated alfalfa):							
0-0.5	SiCL	16.9	--	400	10	.43	10
0.5-1	SiCL	20.1	--	440	0	.15	5
1-1.5	SiCL	20.9	--	360	0	.04	3
1.5-2	SiCL	21.4	--	380	0	.01	3
2-3	SiCL	20.7	28	350	0	.01	4
3-4	SiCL	21.4	--	440	0	.03	3
4-5	SCL	22.3	--	470	0	.00	2
5-6	SiC	20.1	24	370	0	.02	4
6-7	SiCL	19.7	--	420	0	.02	2
7-8	SiL	24.5	--	440	0	.01	0
8-9	SiC	20.4	3.8	360	0	.01	1
9-10	SiC	20.3	--	420	0	.00	0
10-11	SiC	17.4	--	470	0	.02	0
11-12	C-G	20.4	--	370	0	.03	2
12-13	C	25.0	--	420	0	.01	1
13-14	C	25.2	--	450	0	.02	1
14-15	C	17.7	--	420	0	.03	1
Water sample				320	5.4	.04	0
Core 1-D (irrigated alfalfa):							
0-0.5	SiCL	18.1	--	380	26	.13	11
0.5-1	SiCL	20.5	--	420	30	.06	3
1-1.5	SiCL	21.0	--	440	2	.06	3
1.5-2	SiCL	20.8	--	460	2	.06	3
2-3	SiCL	20.8	8.4	490	1	.03	--
3-4	SiCL	22.4	--	450	1	.04	3
4-5	SC	22.6	--	490	1	.02	4
5-6	SiC	23.8	20	400	1	.02	3

Contd.

Table 7.--Location 1: Chemical and physical analyses of cores and water samples taken near Fort Collins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 1-D (contd.):							
6-7	SiCL	23.2	--	430	1	0.02	3
7-8	SiCL	19.4	--	470	0	.04	-
8-9	SiCL	20.0	22	480	2	.01	0
9-10	SiC	19.8	--	410	1	.04	6
10-11	C	16.1	--	440	0	.00	1
11-12	C	18.5	--	440	0	.03	2
12-13	C	18.3	--	450	0	.04	1
13-14	C	27.0	--	440	0	.01	1
14-15	C	19.6	--	470	0	.04	0
Water sample				360	1.0	.03	.1
Core 1-E (irrigated alfalfa):							
0-0.5	SiCL	16.7	--	440	4	.24	8
0.5-1	SiCL	18.5	--	470	2	.13	8
1-1.5	SiCL	19.1	--	470	1	.04	3
1.5-2	SiCL	18.4	--	460	1	--	2
2-3	SiCL	15.8	3.0	360	1	.03	3
3-4	SiCL	17.0	--	400	0	.03	1
4-5	SiCL	20.9	--	490	1	.01	2
5-6	SiCL	17.3	4.3	420	0	.02	3
6-7	SiCL	17.7	--	390	0	.02	1
7-8	SL	14.1	--	390	1	.03	0
8-9	SL	14.1	6.8	410	0	.03	1
9-10	SiCL	15.4	--	440	0	.01	1
10-11	SiCL	17.9	--	470	0	.03	7
11-12	SiCL	18.9	--	400	0	.03	1
12-13	SiL	24.3	--	480	1	.02	2
13-14	SiL	25.9	11.6	410	1	.02	4
14-15	SC	23.4	--	450	0	.03	0
15-16	SC	22.5	--	450	0	.04	1
16-17	SC	19.4	--	420	1	.03	1
17-18	C	22.3	--	470	0	.06	1

Contd.

Table 7.--Location 1: Chemical and physical analyses of cores and water samples taken near Fort Collins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 1-E (contd.):							
18-19	C-G	26.6	--	390	1	0.05	2
19-20	S	22.2	--	430	2	.10	1
Water sample					7.0	.00	.2
Core 1-F (irrigated alfalfa):							
0-0.5	SiCL	19.5	--	380	9	.38	16
0.5-1	SiCL	19.7	--	410	5	.14	7
1-1.5	SiCL	18.5	--	430	1	.04	2
1.5-2	SiCL	16.8	--	440	0	.04	2
2-3	SiCL	14.6	--	340	1	.00	2
3-4	SiCL	13.6	--	460	1	.02	2
4-5	SiCL	16.0	--	420	0	.01	1
5-6	SiCL	16.4	--	430	0	.01	1
6-7	L	14.9	--	330	0	.02	1
7-8	CL	14.8	--	300	1	.00	1
8-9	SCL	11.5	2.6	340	0	.01	1
9-10	SCL	9.7	--	320	0	.02	0
10-11	SiCL	14.0	--	340	0	.05	0
11-12	CL	15.5	3.2	400	0	.03	2
12-13	CL	17.7	--	420	0	.02	1
13-14	CL	18.2	--	470	1	.01	1
14-15	CL	17.9	8.0	480	0	.02	2
15-16	CL	15.0	--	420	0	.03	0
16-17	SC	14.0	--	470	1	.02	1
17-18	SC	16.3	--	480	0	.06	0
18-19	S	15.8	--	500	1	.13	2
19-20	S	18.0	--	510	0	.03	1
20-22	-	--	--	--	--	--	--
22-23	G	11.4	--	480	0	.02	1
Water sample				540	3.3	.03	0

Location No. 2

General Location: 3 miles S. and 2 miles E. of Fort Collins, Colo.
(0.1 mile E. of Harmony School)

General Remarks:

Soils: Nunn clay loam Slope: 0-1 pct.

Corrals: Each corral is usually stocked with 150 cattle for about 6 to 7 months each year. They have been used since about 1937 (fig. 14). The manure is removed once each year and spread on the fields.

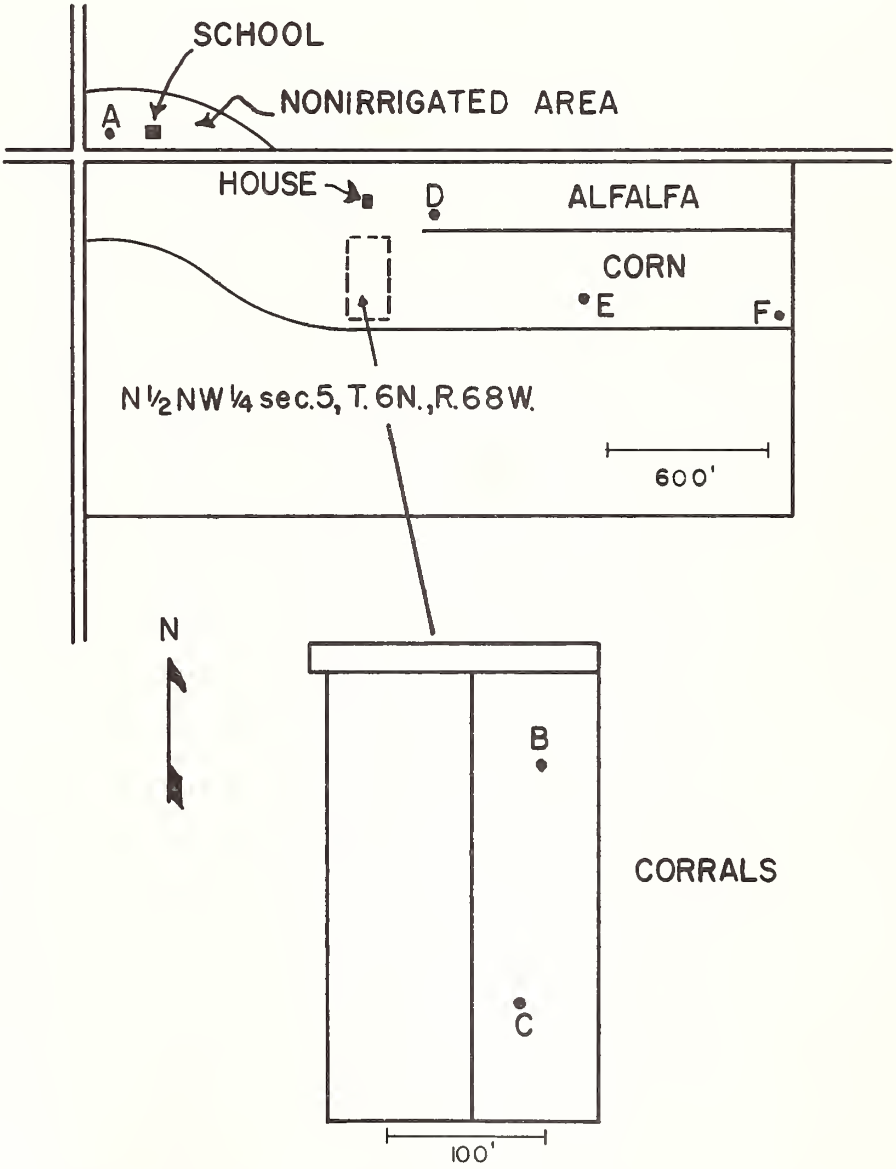


Figure 14.--Location 2 and core sites, near Fort Collins, Colo.

Irrigated Fields: Corn, sugar beets, barley, and alfalfa are the principal crops grown. Cores E and F were taken from a field that was in alfalfa from 1957 to 1960, but has grown barley, beets, and corn since that time. Alfalfa has been grown since 1963 in the area where core D was obtained.

Nonirrigated Area: Core A was taken in the play area by the school house (fig. 14). The area is still in virgin sod.

Fertilizer Practices: Manure is applied to the fields at the rate of 15 tons per acre every 3 years. Very little commercial fertilizer is used, except for small amounts of N for sugar beets.

Water Quality: The well water is not used for human or livestock consumption. The farmer had the water analyzed; the results indicated that it contained very high amounts of nitrate and should not be used for human or livestock consumption. Analyses run during this study showed 39 p.p.m. nitrate-N (172 p.p.m. nitrate) in the well water. The water table fluctuates about 5 feet during a year.

Significant findings:

At this location, cores representing nonirrigated areas (2-A), corrals (2-B and 2-C), irrigated alfalfa fields (2-D), and irrigated corn (2-E and 2-F), were obtained (table 8). The land use greatly affected the amounts of nitrogen compounds found in the profiles. In the nonirrigated field core and in the alfalfa field core, little or no nitrogen was present in any of the forms tested. On the other hand, the corral cores contained significant amounts of nitrate at all depths and significant amounts of ammonium and nitrite in the samples near the surface. The Eh measurements were fairly high for these cores, especially 2-B, and probably account for the nitrate concentrations found. The cores from the irrigated cornfield also contained nitrate at all depth levels, but smaller in magnitude than the levels found under corrals. Both of these situations indicate that nitrate is moving through the soil and into the ground water. The K values give an estimate of the rate of water movement through the soil, which is important in determining the amount of nitrate or other compounds that may be reaching the ground water.

Table 8.--Location 2: Chemical and physical analyses of cores and water samples taken near Fort Collins, Colo., 1966

Core, depth (ft.) and water sample	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 2-A (nonirrigated sod):							
0-0.5	CL	18.0	--	390	2	0.07	5
0.5-1	CL	12.4	--	440	0	.04	3
1-1.5	CL	8.6	--	450	0	.06	3
1.5-2	CL	8.8	--	450	0	.07	2
2-3	CL	10.1	36	400	2	.05	1
3-4	CL	20.2	--	430	2	.05	0
4-5	CL	19.8	--	440	0	.06	2
5-6	CL	20.3	8.2	370	0	.04	2
6-7	CL	22.1	--	430	0	.05	3
7-8	CL	19.4	--	460	2	.05	2
8-9	SiC	22.9	--	340	2	.04	0
9-10	SiC	20.3	--	400	1	.03	1
10-11	SC-G	8.4	--	340	0	.03	1
11-12	SC-G	4.9	--	400	0	.02	0
12-13	SC-G	3.2	--	380	0	.02	1
13-14	SC-G	7.8	--	350	0	.02	1
14-15	C	18.8	--	450	0	.04	2
15-16	C	17.2	5.0	--	0	.04	5
16-17	C	19.7	--	420	0	.02	2
17-18	-	--	--	--	--	--	--
18-19	C	21.6	--	420	0	.04	4
19-20	C	27.8	--	460	0	.00	1
20-21	C	25.9	--	410	0	.02	2
21-22	C	24.2	--	430	2	.05	0
Water sample				400	.1	.03	0

1/ See table 1 for texture symbols.

Contd.

Table 8.--Location 2: Chemical and physical analyses of cores and water samples taken near Fort Collins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 2-B (corral):							
0-0.5	M	148.8	--	420	0	2.1	210
0.5-0.7	CL	18.3	--	370	87	4.3	200
0.7-1	CL	15.7	--	410	150	.14	73
1-1.5	CL	16.0	--	410	100	.14	4
1.5-2	CL	16.5	--	430	31	.28	4
2-3	CL	15.8	3.0	430	4	.24	9
3-4	CL	13.1	--	440	11	.12	3
4-5	CL	10.9	--	440	17	.13	0
5-6	CL	13.6	.6	--	15	.14	2
6-7	CL	14.9	--	430	21	.08	4
7-8	CL	13.6	--	450	26	.05	3
8-9	CL	15.0	3.1	--	34	.10	4
9-10	L	15.6		450	62	.21	2
10-11	L	22.4	17	--	76	.10	3
11-12	L	18.5	--	450	87	.20	3
12-13	L	12.2	--	430	31	.09	1
13-14	L	11.1	--	420	39	.28	3
14-15	GS	7.3	--	430	20	.08	1
15-16	GS	8.6	--	430	14	.07	3
16-17	GS	8.3	--	450	13	.09	2
17-18	SC-G	21.9	1.3	460	19	.05	6
18-19	SC-G	16.3	--	440	9	.16	9
19-20	C-G	14.4	--	460	6	.40	1
20-22	C-G	19.7	--	460	6	.16	2
22-23	C-G	21.6	--	450	0	.33	5
23-24	C-G	19.7	--	440	1	.19	2
24-25	S	14.6	--	290	0	.14	3
25-26	C	18.6	--	390	2	.10	3
Water sample				420	29	2.5	0

Contd.

Table 8.--Location 2: Chemical and physical analyses of cores and water samples taken near Fort Collins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 2-C (corral):							
0-0.5	M	170.8	--	290	--	2.2	160
0.5-0.7	CL	18.5	--	310	100	21	100
0.7-1	CL	15.1	--	350	220	7.6	8
1-1.5	CL	14.2	--	350	88	.51	4
1.5-2	CL	13.8	--	350	24	.65	3
2-3	CL	12.1	3.0	--	--	.31	9
3-4	CL	10.8	--	370	68	.09	0
4-5	CL	12.3	--	380	54	.08	1
5-6	CL	15.7	7.2	--	--	.10	5
6-7	CL	13.5	--	430	110	.06	3
7-8	CL	14.4	--	450	135	.20	5
8-9	CL	18.6	14	--	--	.06	4
9-10	CL	16.9	--	440	135	.13	4
10-11	SiCL	19.8	--	440	157	.14	0
11-12	SiCL	16.3	--	440	81	.18	1
12-13	SiCL	13.4	--	410	32	.03	1
13-14	GS	8.1	12.0	--	--	--	3
14-15	GS	8.7	--	440	16	.06	2
15-16	GS	9.6	--	440	13	.02	2
16-17	GS	15.6	--	430	29	.04	1
17-18	SiL	16.5	--	440	21	.04	1
18-19	SiL	16.4	1.0	--	--	.11	1
19-20	SC-G	16.1	--	440	7	.05	1
20-21	C-G	19.7	--	320	4	.19	4
21-22	SC	--	--	390	4	.12	3
22-23	C	--	--	430	4	.02	3
Water sample				320	25	1.7	0

Contd.

Table 8.--Location 2: Chemical and physical analyses of cores and water samples taken near Fort Collins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 2-D (irrigated alfalfa):							
0-0.5	CL	19.0	--	470	18	0.21	7
0.5-1	CL	21.0	--	480	11	.52	5
1-1.5	CL	18.0	--	490	7	.17	3
1.5-2	CL	17.1	--	490	3	.24	1
2-3	CL	11.6	1.8	--	1	.03	2
3-4	SCL	9.7	--	480	0	.05	4
4-5	SCL	11.9	--	520	0	.02	2
5-6	GCL	16.5	6	--	0	.00	2
6-7	GCL	16.1	--	440	0	.11	2
7-8	GCL	17.3	--	450	1	.05	4
8-9	GCL	15.6	--	--	1	--	3
9-10	GCL	17.3	--	440	1	.50	2
10-11	SiL	17.7	--	450	1	.19	0
11-12	GS	9.5	--	450	1	.23	0
12-13	GS	6.4	--	460	1	.11	3
13-14	S	11.4	--	440	1	.45	1
14-15	S	--	--	--	--	--	--
15-16	S	6.1	--	440	1	.24	0
16-17	S	12.4	--	450	--	.06	0
17-18	GS	5.6	3.8	--	3	.09	0
18-19	GS	8.9	--	370	4	.23	1
19-20	GS	4.5	--	390	2	.06	1
20-21	SC	16.3	--	10	0	--	3
21-22	C	23.9	--	330	14	.05	7
Water sample				-340	44	2.3	0.7

Contd.

Table 8.--Location 2: Chemical and physical analyses of cores and water samples taken near Fort Collins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 2-E (irrigated field):							
0-0.5	CL	20.5	--	470	18	0.37	5
0.5-1	CL	19.4	--	460	37	.47	3
1-1.5	CL	20.6	--	460	6	.18	2
1.5-2	CL	17.8	--	480	1	.22	4
2-3	CL	15.3	--	480	1	.32	2
3-4	CL	13.3	--	470	0	.15	1
4-5	CL	12.4	--	460	4	.25	1
5-6	CL	15.3	--	440	3	.20	3
6-7	CL	12.9	--	430	3	.12	2
7-8	CL	16.5	--	440	1	.12	2
8-9	CL	15.7	--	430	2	.20	1
9-10	CL	18.4	--	440	1	.13	0
10-11	SiL	13.0	--	390	2	.20	1
11-12	SiL	14.2	--	410	3	.10	1
12-13	--	--	--	--	--	--	--
13-14	SiL	13.3	--	420	2	.20	1
14-15	SiC	18.0	--	410	2	--	0
15-16	SiC	17.5	--	420	3	.12	1
16-17	C	20.3	--	460	3	.17	0
17-18	C	28.7	--	440	4	.14	2
18-19	C	19.1	--	470	4	.18	0
19-20	C	25.9	--	460	9	.09	1
Water sample				370	14	.06	0.1

Contd.

Table 8.--Location 2: Chemical and physical analyses of cores and water samples taken near Fort Collins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 2-F (irrigated field):							
0-0.5	CL	19.0	--	400	41	0.21	9
0.5-1	CL	18.1	--	430	9	.13	16
1-1.5	CL	16.2	--	440	5	.05	3
1.5-2	CL	13.8	--	450	2	.05	2
2-3	CL	14.0	2.9	--	3	.03	6
3-4	CL	16.9	--	440	3	.01	3
4-5	CL	18.3	--	480	3	.02	1
5-6	CL	21.0	14	--	3	.01	1
6-7	CL	18.8	--	470	3	.03	2
7-8	SL	13.1	--	470	1	.03	1
8-9	SL	12.8	5.0	450	5	.01	5
9-10	SL	15.3	--	430	4	.05	3
10-11	SiL	17.6	--	460	6	.04	4
11-12	SiL	21.8	--	390	9	.01	5
12-13	SiL	18.3	--	420	6	.00	0
13-14	SiC	19.0	--	430	9	.01	1
14-15	SiC	21.0	9.0	460	8	.02	1
15-16	CL	19.1	--	440	7	.04	1
16-17	SC	21.5	--	470	7	.08	1
17-18	SC	21.5	--	460	6	.05	1
18-19	SC	22.4	--	470	21	.05	0
19-20	C	22.5	--	420	14	.04	1
20-21	C	25.6	--	450	20	.05	3
Water sample				360	36	.04	0.1

Location No. 3

General Location: 3 miles S.; 4 miles E.; and 1 mile S. of Loveland, Colo.

General Remarks:

Soils: Cores A, B, and C - Weld loam Slope: 1-2 pct.
Cores D and E - Weld loam Slope: 0-1 pct.
Cores F and G - Colby loam Slope: 1-2 pct.

Corrals: The corral is about 65 years old (fig. 15). Approximately 250 cattle are fed in the corral the year around. Manure is removed once a year, usually in the fall.

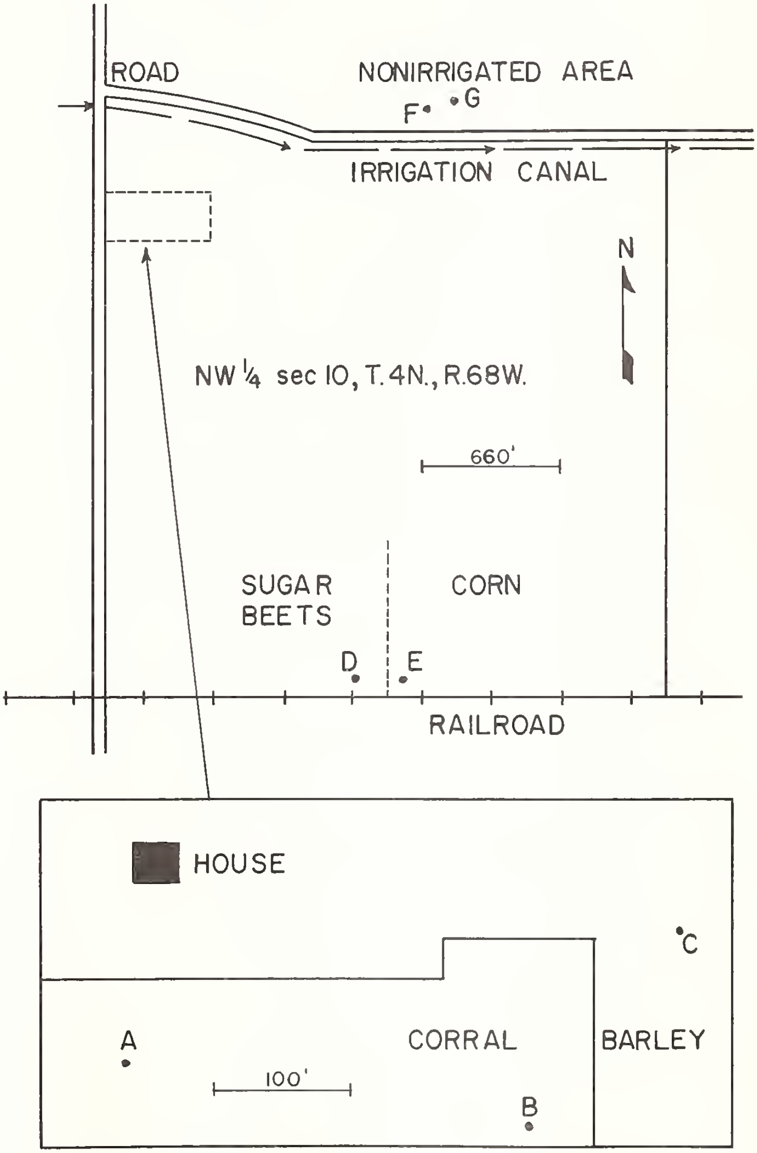


Figure 15.--Location 3 and core sites, near Loveland, Colo.

Irrigated Fields: A rotation of alfalfa (3 years), corn, sugar beets, and barley is usually followed. The length of time since alfalfa was grown for the areas where cores D, E, and C were obtained was 2, 6, and 10 years, respectively.

Nonirrigated areas: The area is alternated between wheat and fallow and has been under cultivation since about 1882.

Fertilizer Practices: Manure is applied to the beet fields at the rate of 15 to 20 tons per acre. An additional 100 pounds of N per acre and 50 pounds of P_2O_5 per acre are applied as commercial fertilizers. Corn is usually planted on fields that have previously been in alfalfa, and only 50 pounds of N per acre are applied as commercial fertilizer.

No fertilizer has been applied to the nonirrigated areas.

Significant findings:

Cores 3-A and 3-B were taken from corrals and show contrasting amounts of nitrate present (table 9). Core 3-A had a large amount of nitrate, whereas core 3-B had almost no nitrates present in the first 5 feet. These differences are probably caused by the different aeration status of the two cores. Core 3-A had high Eh values for all the depths. The Eh values for the first few feet of core 3-B were all below 300 mv., which is lower than the value believed necessary for the accumulation of nitrate in soil (7,9).

Of the cores from the irrigated areas, only 3-D showed appreciable amounts of nitrate in the profile. One core from the nonirrigated area (3-G) also showed substantial amounts of nitrate-N. This area was in fallow, which may account for the nitrate present.

Table 9.--Location 3: Chemical and physical analyses of cores and water samples taken near Loveland, Colo., 1966

Core, depth (ft.) and water sample	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 3-A (corral):							
0-0.2	SiCL	19.1	--	440	70	60	40
0.2-5	SiCL	18.5	--	450	86	1.6	6
0.5-1	SiCL	19.3	--	460	83	.02	5
1-1.5	SiCL	14.1	--	460	100	.02	6
1.5-2	SiCL	19.6	--	450	150	.05	4
2-3	SiCL	18.3	9.3	--	110	.08	5
3-4	SiCL	21.0	--	450	130	.03	4
4-5	L	17.1	--	480	44	.04	2
5-6	L	15.7	7.2	--	16	.03	4
6-7	L	16.8	--	430	15	.02	1
7-8	L	17.6	--	450	9	.05	3
8-9	L	22.7	16	--	2	.01	3
9-10	L	22.8	--	430	1	.03	5
10-11	L	28.4	--	440	0	.01	5
11-12	SL	24.3	--	470	0	.04	5
12-13	SL	24.5	--	470	2	.15	2
Water sample				460	.1	.01	2.1
Core 3-B (corral):							
0-0.2	M	96.5	--	200	0	0	260
0.2-.5	M	--	--	--	--	--	--
0.5-1	SiCL	20.5	--	270	2	3.4	33
1-1.5	SiCL	20.3	--	290	2	.45	36
1.5-2	SiCL	19.7	--	290	1	.13	15
2-3	SiCL	17.6	3.0	--	1	.04	10
3-4	SiCL	18.2	--	390	1	.04	3
4-5	SiCL	18.3	--	400	3	.04	1
5-6	SL	19.3	29	--	35	.42	5
6-7	L	13.9	--	370	43	.54	4
7-8	L	13.1	--	390	48	.76	2
8-9	L	15.3	33	370	7	.41	7
9-10	SiC	24.0	--	360	1	.06	4

1/ See table 1 for texture symbols.

Contd.

Table 9.--Location 3: Chemical and physical analyses of cores and water samples taken near Loveland, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 3-B (contd.):							
10-11	SiC	23.0	--	370	0	0.03	2
11-12	SL	20.8	--	400	0	.04	2
12-13	SL	23.1	--	420	0	.04	3
13-14	SL	25.8	--	340	0	.01	5
14-15	C	23.5	--	370	0	.04	8
15-16	C	19.7	--	420	0	.03	6
16-17	C	25.9	--	390	1	.04	4
17-18	SC	21.4	--	380	1	.03	1
18-19	SC	21.6	--	390	--	.03	1
Water sample				200	0	.00	1.7
Core 3-C (irrigated field):							
0-0.5	SiCL	17.4	--	440	48	.06	2
0.5-1	SiCL	21.5	--	450	13	.04	5
1-1.5	SiCL	20.4	--	470	6	.04	6
1.5-2	SiCL	20.2	--	490	5	.06	6
2-3	SiCL	--	4.3	--	2	.02	7
3-4	SiCL	19.7	--	400	0	.02	4
4-5	SiCL	20.1	--	430	0	.04	2
5-6	SiCL	10.2	4.8	460	2	.06	7
6-7	SiCL	16.8	--	440	2	.03	6
7-8	SiCL	18.4	--	430	4	.03	3
8-9	SL	16.6	--	420	0	.01	2
9-10	SL	19.1	--	400	0	.02	4
10-11	CL	18.5	--	440	0	.04	2
11-12	CL	19.9	--	430	0	.02	8
12-13	SCL	17.2	--	480	1	.03	8
13-14	SCL	22.3	--	480	0	.01	2
14-15	SCL	21.6	--	450	1	.02	2
15-16	C	17.8	6.7	--	0	.05	7
16-17	C	17.0	--	430	1	.01	2
17-18	C	20.4	--	440	0	.02	6
Water sample				280	.7	.00	0

Contd.

Table 9.--Location 3: Chemical and physical analyses of cores and water samples taken near Loveland, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 3-D (irrigated field):							
0-0.5	SiCL	15.2	--	430	33	0.03	1
0.5-1	SiCL	21.1	--	500	28	.04	5
1-1.5	SiCL	18.7	--	520	8	.02	3
1.5-2	SiCL	19.1	--	520	5	.02	5
2-3	CL	19.6	1.5	390	2	.04	7
3-4	CL	21.7	--	450	3	.03	3
4-5	SiCL	23.8	--	470	3	.03	3
5-6	SiCL	25.7	16	--	9	.02	3
6-7	CL	28.6	--	360	21	.00	2
7-8	CL	25.4	--	420	7	.04	2
8-9	CL	23.5	4.2	--	2	.03	3
9-10	CL	25.0	--	380	8	.02	2
10-11	SiL	27.7	--	410	0	.02	1
Water sample				331	--	.01	.2
Core 3-E (irrigated field):							
0-0.5	SiCL	18.4	--	470	12	.09	7
0.5-1	SiCL	20.4	--	470	24	.04	3
1-1.5	SiCL	18.7	--	480	3	.04	5
1.5-2	SiCL	16.2	--	490	2	.03	12
2-3	CL	27.0	--	--	1	.05	4
3-4	CL	18.7	--	450	1	.04	3
4-5	SiCL	21.3	--	490	1	.00	4
5-6	SiCL	21.2	5.7	460	1	.03	4
6-7	SiCL	21.5	--	440	1	.05	4
7-8	SiCL	23.3	--	440	0	.03	1
8-9	SC	22.8	2.3	450	0	.04	6
9-10	SC	23.3	--	460	1	.04	3
10-11	SiC	28.1	--	470	0	.05	4
11-12	SiC	28.1	--	440	0	.03	4
12-13	C	22.2	--	450	0	.02	7
Water sample				400	.9	.01	0

Contd.

Table 9.--Location 3: Chemical and physical analyses of cores and water samples taken near Loveland, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 3-F (nonirrigated cultivated field):							
0-0.5	SiL	10.0	--	350	22	0.04	2
0.5-1	SiL	12.7	--	430	31	.04	3
1-1.5	SiL	17.0	--	440	9	.00	4
1.5-2	SiL	15.4	--	450	2	.08	2
2-3	SiL	17.6	--	--	2	.05	2
3-4	SiL	16.3	--	370	1	.02	1
4-5	L	18.0	--	410	1	.02	2
5-6	SC	13.0	1.5	--	1	.04	3
6-7	SC	21.7	--	430	1	.02	6
7-8	C	23.1	--	430	--	.01	3
8-9	C	18.9	1.9	--	1	.03	4
9-10	C-Sh	18.5	--	420	1	.00	3
10-11	C-Sh	18.0	--	420	1	.00	3
11-12	C-Sh	17.0	--	430	1	.02	2
Core 3-G (nonirrigated cultivated field):							
0-0.5	SiL	12.8	--	350	14	.09	8
0.5-1	SiL	9.6	--	370	3	.03	12
1-1.5	SiL	12.7	--	380	1	.01	5
1.5-2	SiL	10.4	--	410	2	.02	9
2-3	SiL	8.7	--	--	11	.10	3
3-4	SiL	11.3	--	350	14	.01	2
4-5	SiL	14.2	--	380	9	.01	9
5-6	SiL	12.9	6.8	--	4	.02	2
6-7	SiC	21.8	--	410	11	.00	4
7-8	SiL	12.4	--	420	5	.00	3
8-9	SC	13.3	5.2	--	6	.02	4
9-10	SC	14.3	--	330	5	.00	3
10-11	C-Sh	15.5	--	400	3	.00	5
11-12	C	14.2	--	410	2	.00	5
12-13	C	14.2	--	420	1	.02	8
13-14	C-Sh	15.2	--	430	1	.03	6

Location No. 4

General Location: 1 mile E. and 2 miles S. of Johnstown, Colo.

General Remarks:

Soils: Cores A, B, C, and D - Colby loam Slope: 1-3 pct.
Cores E and F - Colby loam Slope: 3-5 pct.

Corrals: The smaller corral is about 25 years old, and the larger one is 7 years old (fig. 16). The corrals are stocked with about 300 cattle and are used 5 or 6 months during the year. The manure is removed in the fall and spread on the fields.

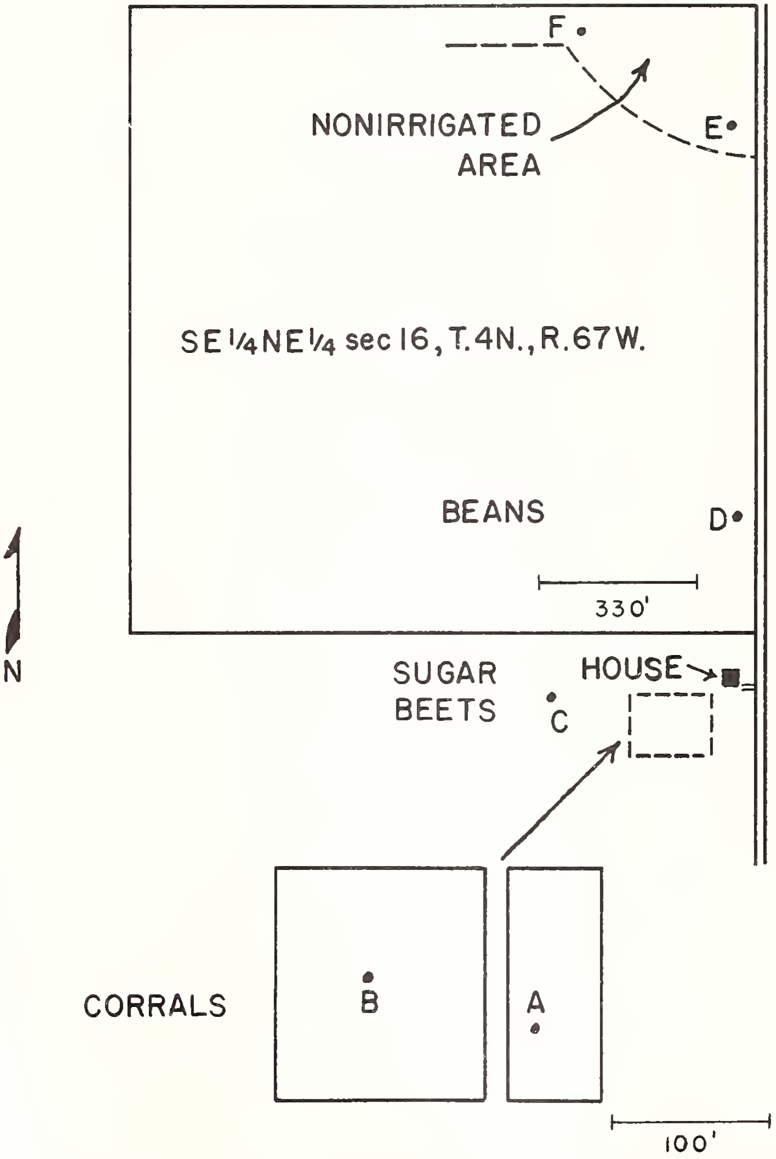


Figure 16.--Location 4 and core sites, near Johnstown, Colo.

Irrigated Fields: Alfalfa, corn, beans and sugar beets are grown in rotation. Generally, alfalfa is left for 3 years, followed by one crop each of the other crops. However, cores C and D (fig. 16) were taken from areas that had not been in alfalfa for 8 years.

Nonirrigated Fields: The field has been cultivated since about 1915 and is alternated between wheat and fallow. Cores E and F were taken from wheat and fallow areas, respectively.

Fertilizer Practices: Manure is spread on the sugar beet fields at the rate of 25 tons per acre. In addition, 80 pounds of N and 135 pounds of P_2O_5 are applied per acre as commercial fertilizers. Corn generally follows alfalfa and receives only 100 pounds of N per acre as commercial fertilizer.

No fertilizer has been used on the nonirrigated fields.

Significant findings:

The corral cores, 4-A and 4-B, have fairly high concentrations of nitrate (table 10). This is particularly true for core 4-A. At this location, no water table was present and the length of the cores was limited by the shale layers. Nitrite was found in quantity in the soil immediately below the manure layer, as was the case in corral cores from several other locations. Generally, there is little or no nitrate present in the manure layer, both nitrate and nitrite immediately below, and mainly nitrate at deeper depths. This pattern is undoubtedly caused by the high oxygen demand in the manure layer for the decomposition processes to continue.

The cores from the irrigated areas were not very high in nitrate, especially at the lower depths. However, these cores were relatively shallow and represent mainly the root zone. Data of the cores from the nonirrigated area, 4-E and 4-F, show practically no nitrate present except at depths below 10 feet. The amounts there were not excessive, but from 1 to 3 p.p.m. N was found in all samples except one. This suggests that in this area, even when the field is not irrigated, there is some movement of nitrate to depths below the rooting zone. The annual rainfall in this area averages about 15 inches.

Table 10.--Location 4: Chemical and physical analyses of cores taken near Johnstown, Colo., 1966

Core and depth (ft.)	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 4-A (Corral):							
0-0.2	M	--	--	110	-0	--	--
0.2-0.4	M	--	--	--	--	--	--
0.4-0.7	SiL	16.8	--	280	--	18	2
0.7-1	SiL	17.7	--	310	175	.40	7
1-2	SiL	16.7	--	330	155	.11	6
2-3	SiL	14.9	4.4	--	130	.03	4
3-4	SiL	15.6	--	350	140	.06	7
4-5	SiL	--	--	--	--	--	--
5-6	SiL	16.6	--	360	112	.04	1
6-7	SiL	21.4	1.9	--	49	.09	1
7-8	Si	28.6	--	380	19	.05	1
8-9	Si	22.3	--	400	11	.07	2
9-10	SL	15.7	--	390	4	.28	8
10-12		--	--	--	--	--	--
12-13	C-Sh	20.7	--	390	25	.13	6
Core 4-B (Corral):							
0-0.2	M	--	--	140	6	.02	3
0.2-0.4	M	--	--	--	--	--	--
0.4-0.7	SiL	18.9	--	270	55	6.5	690
0.7-1	SiL	16.3	--	320	140	.54	3
1-1.5	SiL	17.5	--	340	4	--	0
1.5-2	SiL	15.6	9.0	--	3	.07	8
2-3	SiL	16.1	--	390	1	.03	4
3-4	SiL	17.0	--	380	1	.01	1
4-5	SiL	17.5	30	--	2	.01	1
5-6	SiL	21.4	--	410	1	.00	7
6-7	SL	19.2	--	390	1	.34	1
7-8	SL-Sh	15.5	--	380	2	.03	1

1/ See table 1 for symbols.

Contd.

Table 10.--Location 4: Chemical and physical analyses of cores taken near Johnstown, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 4-C (irrigated field):							
0-0.5	SiL	18.0	--	400	88	0.04	1
0.5-1	SiL	23.7	--	410	62	.05	1
1-1.5	SiL	18.9	--	430	93	--	--
1.5-2	SiL	17.8	--	450	63	.21	4
2-3	SiL	17.0	20	--	8	.02	1
3-4	SiL	18.1	--	400	14	.03	3
4-5	SiL	19.5	--	420	3	.04	2
5-6	SiL	20.8	23	--	2	.01	2
6-7	SiL	22.0	--	410	2	.06	10
7-8	SiL	30.8	--	430	1	.04	3
8-9	SiL	32.5	--	430	1	.03	1
9-10	SL	25.3	--	440	1	.03	0
10-11	SL-Sh	29.4	--	410	0	.03	4
Core 4-D (irrigated field):							
0-0.5	SiL	17.2	--	410	11	.02	4
0.5-1	SiL	12.7	--	430	6	.03	3
1-1.5	SiL	11.0	--	460	3	.07	2
1.5-2	SiL	8.8	--	430	1	.03	4
2-3	SiL	7.6	2.2	--	0	.02	4
3-4	SiL	8.8	--	420	1	.14	1
4-5	SL	12.1	--	410	1	.03	2
5-6	SL	13.5	.2	--	1	.02	3
6-7	SL	13.9	--	430	1	.06	1
7-8	SiL	19.1	--	450	0	.05	1
8-9	SiL	18.1	14	--	0	.04	0
9-10	SL	15.6	--	410	1	.05	0
10-11	S-C	17.1	--	400	1	.04	0
11-12	C-Sh	16.7	--	420	0	.04	0

Contd.

Table 10.--Location 4: Chemical and physical analyses of cores taken near Johnstown, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 4-E (nonirrigated cultivated field):							
0-0.5	SiL	7.0	--	350	1	0.06	39
0.5-1	SiL	7.6	--	390	1	.02	15
1-1.5	SiL	8.4	--	440	0	.02	5
1.5-2	SiL	5.9	--	450	0	.02	3
2-3	SiL	3.0	.2	--	0	.04	1
3-4	SiL	8.4	--	330	0	.00	3
4-5	SiL	8.7	--	380	1	.01	3
5-6	SiL	13.8	1.2	--	0	.02	2
6-7	SiL	10.5	--	350	0	.00	0
7-8	SiL	11.4	--	390	0	.00	0
8-9	SL	8.1	1.6	--	0	.02	2
9-10	SL	12.1	--	340	0	.00	1
10-11	SL	11.5	--	340	0	.01	5
11-12	SiL	13.4	--	410	3	.00	0
12-13	CL	9.3	--	410	2	.01	0
13-14	CL	9.9	--	430	3	.01	0
14-15	SL	10.8	--	440	3	.01	0
15-16	SL	11.3	--	450	1	.01	1
16-17	SL	12.4	--	440	1	.01	2
17-18	SL	14.6	--	350	2	.00	0
18-19	S	16.5	--	340	3	.02	2
19-20	SL	19.7	--	360	0	.03	1
20-21	SL-Sh	20.4	--	390	1	.02	1

Contd.

Table 10.--Location 4: Chemical and physical analyses of cores taken near Johnstown, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 4-F (nonirrigated cultivated field):							
0-0.5	SiL	12.3	--	460	2	0.03	2
0.5-1	SiL	12.8	--	460	1	.02	3
1-1.5	SiL	9.6	--	430	1	.01	4
1.5-2	SiL	5.4	--	450	0	.01	1
2-3	SiL	--	.1	--	0	.00	2
3-4	SiL	6.0	--	390	0	.00	4
4-5	SiL	6.7	--	430	0	.00	2
5-6	SiL	11.3	.3	--	0	.01	4
6-7	SiL	8.9	--	370	0	.02	1
7-8	SiL	10.6	--	390	0	.01	2
8-9	--	--	--	--	-	--	--
9-10	SL	10.1	--	380	0	.01	2
10-11	SL	8.9	--	370	1	.01	1
11-12	CL	4.8	.3	--	2	.02	1
12-13	SL	4.9	--	380	2	.05	0
13-14	SL	5.3	--	400	2	.03	2
14-15	Sh	9.3	--	400	3	.02	0

Location No. 5

General Location: 1 mile E. of Pierce, Colo.

General Remarks:

Soils:	Cores A, B, and C - Ascalon sandy loam	Slope:	0-1 pct.
	Core D - Ascalon loam	Slope:	0-1 pct.
	Cores E and F - Platner sandy loam	Slope:	1-3 pct.

Corrals: The corrals generally contain 100 cattle (fig. 17). The manure is removed once a year and spread on the fields.

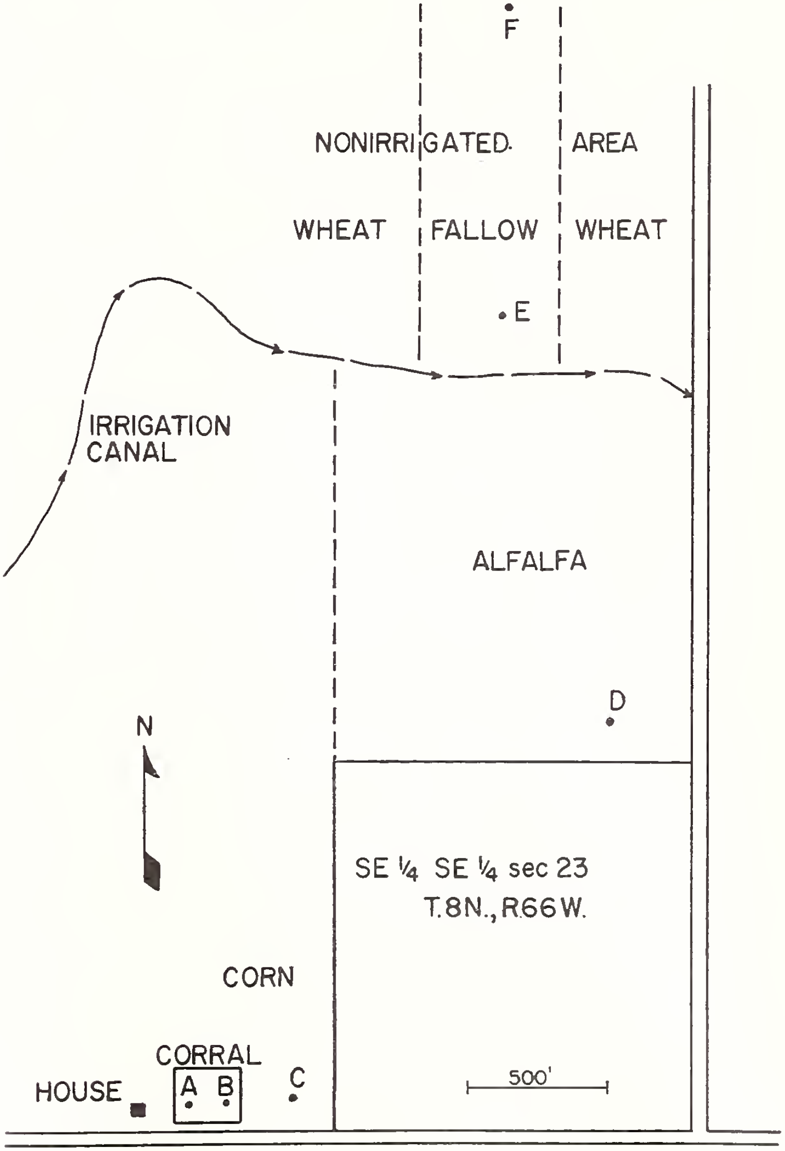


Figure 17.--Location 5 and core sites, near Pierce, Colo.

Irrigated Fields: Core D was taken from an area that had been in alfalfa for 2 consecutive years (fig. 17). Alfalfa had not been grown for several years at the site where core C was obtained.

Nonirrigated Fields: The fields are alternated between wheat and fallow.

Fertilizer Practices: Manure and commercial fertilizers are both used on the irrigated fields. The specific rates were not determined. No fertilizer has been applied on the nonirrigated fields.

Significant findings:

In general, there were no excessive amounts of nitrate found in any of the cores at this location. However, the data for the nonirrigated cores, and for 5-E in particular, show an accumulation of nitrate at depths between 6 and 10 feet (table 11). The area is alternated between fallow and wheat, and this zone of accumulation is probably below the root zone.

Table 11.--Location 5: Chemical and physical analyses of cores and water samples taken near Pierce, Colo., 1966

Core, depth (ft.) and water sample	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 5-A (corral):							
0-0.2	L	19.8	--	450	73	0.09	95
0.2-0.5	L	17.3	--	450	33	.00	0
0.5-1	L	14.5	--	450	28	.01	10
1-1.5	L	13.5	--	460	25	.09	0
1.5-2	L	18.7	--	460	45	.11	1
2-3	L	4.9	2.1	--	--	.01	1
3-4	SL	6.2	--	420	10	.01	1
4-5	SL	4.7	--	410	4	.00	0
5-6	SL	5.8	--	370	1	.00	8
6-7	SL	3.6	--	--	--	.00	0
7-8	SL	7.8	--	410	1	.02	0
8-9	SL	9.8	--	430	2	.05	0
9-10	GS	6.4	--	410	1	.03	3
10-11	GS	11.4	--	400	1	.01	0
11-12	GS	4.7	--	390	1	.00	1
12-13	GS	4.5	--	390	1	.00	0
13-14	GS	4.5	--	400	2	.03	0
14-15	GS	4.3	--	370	1	.00	1
15-16	S-C	17.8	--	400	2	.00	1
16-17	S-C	17.4	--	390	1	.01	0
17-18	GS	2.9	--	520	1	.01	0
18-19	GS	6.8	--	490	0	.00	2
19-20	GS	10.3	--	430	1	.01	0
20-21	GS	10.7	--	440	1	.05	0
21-22	GS	10.9	--	--	1	.06	0
Water sample				390	8.8	.21	.1

1/ See table 1 for texture symbols.

Contd.

Table 11.--Location 5: Chemical and physical analyses of cores and water samples taken near Pierce, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 5-B (corral):							
0-0.2	L	20.1	--	510	180	0.80	150
0.2-0.5	L	16.6	--	510	43	.02	370
0.5-1	L	15.4	--	500	20	.05	38
1-1.5	L	17.8	--	500	12	.11	27
1.5-2	L	15.5	--	490	12	.21	20
2-3	L	7.5	8.2	--	6	.06	13
3-4	SL	10.4	--	440	5	.02	0
4-5	SL	9.1	--	470	7	.00	0
5-6	SL	5.8	2.0	--	4	.00	0
6-7	SL	8.3	--	420	3	.01	0
7-8	L	11.9	--	460	2	.02	0
8-9	L	7.3	1.3	--	0	.00	0
9-10	L	11.2	--	420	2	.00	0
10-11	GS	6.6	--	390	0	.00	0
11-12	GS	1.3	--	430	0	.01	3
12-13	GS	2.1	--	440	0	--	1
13-14	GS	2.2	--	370	1	.06	0
14-15	SC	12.0	--	400	2	--	1
15-16	SC	9.4	--	380	--	.03	0
16-17	SC	15.1	--	380	3	.05	0
17-18	GS	4.6	--	100	0	--	1
18-19	SC	12.7	--	380	1	--	1
19-20	SC	13.8	--	300	--	.06	4
20-21	SC	20.2	--	50	1	.02	1
21-22	SC	15.1	--	250	1	.06	5
22-23	C-S	14.0	--	340	1	.04	5
23-24	C-G	10.6	--	320	1	.02	0
Water sample				40	8.0	.26	0.1

Contd.

Table 11.--Location 5: Chemical and physical analyses of cores and water samples taken near Pierce, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 5-C (irrigated field):							
0-0.5	L	11.7	--	450	50	0.02	0
0.5-1	L	12.9	--	450	56	.02	0
1-1.5	L	11.7	--	460	90	.37	0
1.5-2	L	10.6	--	470	41	.27	0
2-3	L	9.0	7.3	--	9	.08	0
3-4	SL	7.9	--	460	5	.03	0
4-5	SL	9.5	--	460	2	.00	0
5-6	SL	6.4	6.4	--	1	.00	0
6-7	SL	6.5	--	410	0	.00	1
7-8	G-L	4.6	--	340	1	.00	1
8-9	GS	1.2	--	350	0	.01	2
9-10	GS	2.2	--	360	0	.00	0
10-11	GS	2.1	--	320	0	.01	1
11-12	GS	2.1	--	100	0	.01	3
12-13	GS	1.3	--	130	0	.01	3
13-14	GS	2.1	.2	400	0	.02	1
14-15	GS	3.2	--	460	0	.00	0
15-16	GS	8.5	--	550	0	.01	0
16-17	GS	11.1	--	470	0	.02	0
17-18	GS	8.7	.9	420	0	.01	2
18-19	GS	7.9	--	90	0	.00	1
19-20	L	14.2	--	290	0	.00	1
20-21	S	14.6	--	350	1	.02	2
21-22	SC	14.6	--	330	0	.01	0
22-23	S	13.9	--	310	0	.01	0
23-24	S	14.7	--	270	0	.02	1
24-25	S	17.5	--	330	1	.02	1
Water sample				-50	3.0	.27	0

Contd.

Table 11.--Location 5: Chemical and physical analyses of cores and water samples taken near Pierce, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 5-D (irrigated alfalfa):							
0-0.5	L	12.5	--	510	4	0.01	20
0.5-1	L	13.3	--	500	2	.00	2
1-1.5	L	13.0	--	500	0	.06	4
1.5-2	L	11.3	--	510	0	.07	5
2-3	L	6.4	.2	--	2	.02	1
3-4	L	9.8	--	450	2	.01	0
4-5	SL	8.9	--	470	3	.04	3
5-6	SL	4.0	1.4	--	1	.01	0
6-7	SL	12.1	--	440	4	.10	1
7-8	SL	12.8	--	460	1	.05	0
8-9	SL	9.6	--	--	0	--	0
9-10	SL	11.5	--	450	0	.00	0
10-11	GS	9.2	--	480	0	.04	0
11-12	GS	8.9	--	440	0	.00	0
12-13	C	18.5	--	430	0	.03	0
13-14	C	25.3	--	390	0	--	0
14-15	GS	15.9	--	360	0	.03	3
15-16	GS	20.1	--	350	1	.01	2
Water sample				320	5.5	.07	.1

Contd.

Table 11.--Location 5: Chemical and physical analyses of cores and water samples taken near Pierce, Colo., 1966--Continued

Core, depth (ft) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 5-E (nonirrigated cultivated field)							
0-0.5	SL	7.4	--	620	2	0.01	2
0.5-1	SL	12.5	--	610	1	.00	2
1-1.5	SL	11.3	--	590	1	.00	0
1.5-2	SL	11.9	--	580	1	.00	0
2-3	SL	13.9	--	--	1	.00	6
3-4	SL	7.5	--	530	0	.00	0
4-5	SL	6.5	--	540	0	.00	0
5-6	SL	7.4	.2	--	1	.00	2
6-7	SL	7.8	--	350	7	.01	0
7-8	SL	11.5	--	410	31	.01	2
8-9	SL	9.8	1.5	--	63	.05	0
9-10	SC-G	7.1		460	33	.03	0
10-11	GS	0.7	--	490	3	.01	1
11-12	GS	2.5	--	490	0	.02	1
12-13	GS	0.8	--	430	1	.02	1
13-14	S-C	3.2	--	550	0	.01	4
14-15	S-C	8.0	--	400	0	.01	2
15-16	GS	2.2	--	530	1	.01	2
16-17	GS	3.3	--	520	0	.00	2
17-18	GS	11.9	--	480	0	.00	2
18-19	GS	10.1	--	430	0	.00	0
19-20	GS	12.5	--	440	1	.00	2
20-21	GS	10.7	--	420	1	.01	1
21-22	S-C	14.4	--	360	1	.00	1
Water sample				330	7.0	.06	0

Contd.

Table 11.--Location 5: Chemical and physical analyses of cores and water samples taken near Pierce, Colo.,--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 5-F (nonirrigated cultivated field):							
0-0.5	SL	7.2	--	550	2	0.00	0
0.5-1	SL	14.0	--	550	1	.01	1
1-1.5	SL	9.3	--	560	1	.02	2
1.5-2	SL	5.5	--	570	0	.00	0
2-3	SL	6.3	.5	--	0	.00	0
3-4	SL	4.7	--	490	0	.00	0
4-5	SL	5.0	--	530	0	.00	0
5-6	SL	7.2	.9	--	0	.00	1
6-7	SL	7.2	--	440	1	.01	0
7-8	SL	15.3	--	440	3	.00	1
8-9	S	8.6	.7	--	3	.02	2
9-10	S	7.8	--	420	2	.02	3
10-11	GS	5.7	--	390	1	.02	1
11-12	GS	4.4	--	420	0	.02	1
12-13	GS	1.8	--	330	0	.01	1
13-14	GS	1.2	--	370	0	.01	2
14-15	G-C	4.8	--	350	0	.01	2
15-16	G-C	5.7	--	300	0	.02	1
16-17	G-C	0.9	--	350	0	.02	2
17-18	G-C	6.2	--	390	0	.00	3
18-19	GS	1.2	--	310	0	.01	2
19-20	S	1.9	--	370	0	.02	2
20-21	S	2.0	--	420	0	.01	5
21-22	S	1.5	--	390	0	.02	2
22-23	S	1.9	--	430	0	.01	1
23-24	S	2.4	--	410	0	.01	2
24-25	S	2.6	--	610	0	.02	2
25-26	GS	8.9	--	500	0	.01	1
26-27	GS	14.6	--	370	1	.00	1
Water sample				110	9.5	.09	--

Location No. 6

General Location: 1 mile N. and 3-1/2 miles E. of Ault, Colo.

General Remarks:

Soils: Nunn clay loam Slope: 0-1 pct.

Corrals: The corrals range in age from 10 to 50 years. Cores A and B were obtained from the 10-year-old corral (fig. 18). Cores C and D were taken from the 40- and 50-year-old corrals, respectively. Approximately 100 cattle are kept in each of the larger corrals continuously. The small corral is used intermittently. The manure is removed in the spring and spread on the fields.

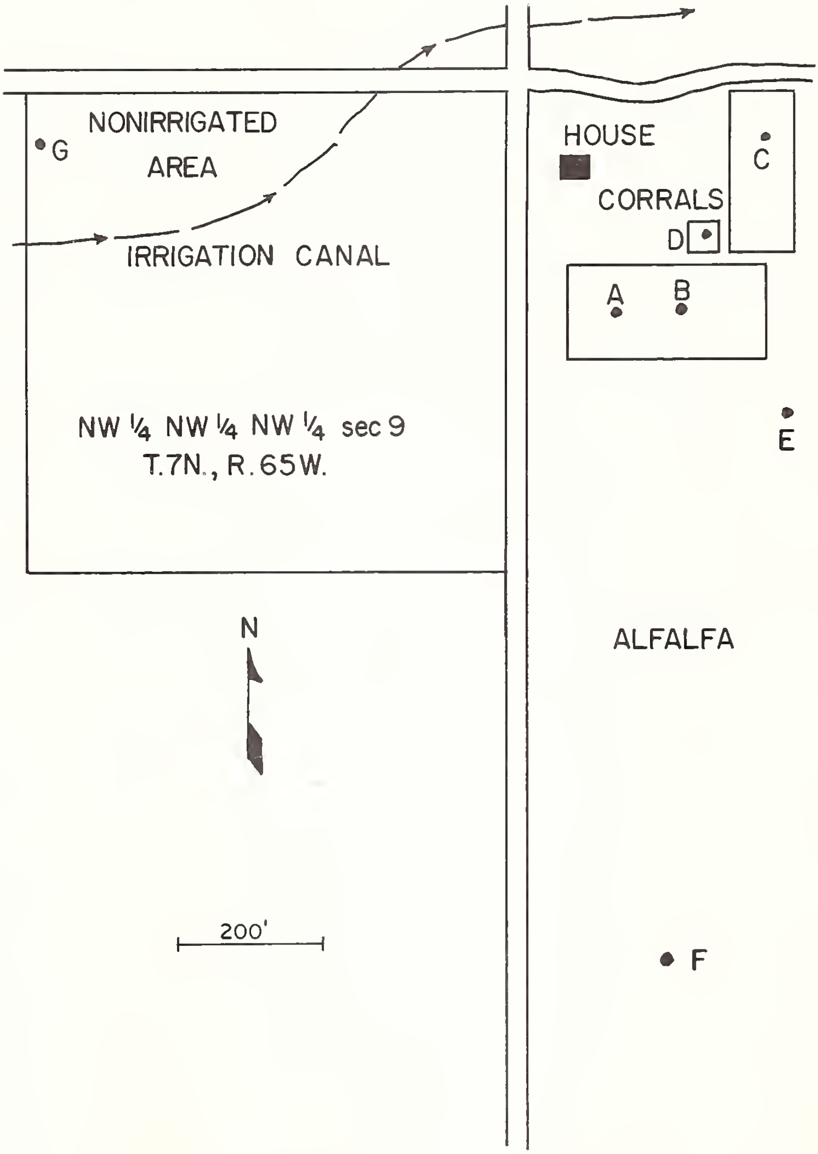


Figure 18.--Location 6 and core sites, near Ault, Colo.

Irrigated Fields: A rotation system of alfalfa (3 years), corn, beans, and beets is followed. Cores E and F were taken from a field that had been in alfalfa for 2 years.

Nonirrigated Area: Core G was obtained from wasteland that lies above the ditch. The area is not farmed and is subject to infrequent flooding.

Fertilizer Practices: Manure, at the rate of 20 tons per acre, is applied to the fields before corn or sugar beets are grown. Commercial fertilizer is used to furnish an additional 100 pounds of N per acre for corn and 60 pounds per acre for sugar beets.

Water Quality: The farmer stated that no problems have been experienced with the water. Well water is used for both livestock and human consumption.

Significant findings:

The highest concentration of nitrate in any core analyzed was found in core 6-C at this location (table 12). The other corral cores, 6-A, 6-B, and 6-D, also had large amounts of nitrate. In most cases, there was a sharp reduction of nitrate at about 2 feet, corresponding to a texture change and decrease in water percentage. The surface samples contained high levels of ammonium-N, but the concentrations decreased rapidly with depth. Cores from the alfalfa field and the nonirrigated wasteland contained only small amounts of nitrate.

Table 12.--Location 6: Chemical and physical analyses of cores and water samples taken near Ault, Colo., 1966

Core, depth (ft.) and water sample	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 6-A (corral):							
0-0.2	CL	10.9	--	260	5	0.42	700
0.2-0.5	CL	12.5	--	360	130	.19	1,080
0.5-1	SiCL	14.0	--	390	160	.39	13
1-1	SiCL	14.5	--	360	54	.12	45
2-3	GS	0.7	--	--	1	.0	4
3-4	GS	0.8	--	370	2	.0	5
4-5	GS	0.4	--	340	0	.0	4
5-6	GS	1.3	--	380	1	.0	0
6-7	GS	1.3	--	330	2	--	1
7-8	GS	1.6	--	340	1	--	2
8-9	GS	1.3	--	340	3	--	2
9-10	GS	1.4	--	370	0	.02	1

1/ See table 1 for texture symbols.

Contd.

Table 12.--Location 6: Chemical and physical analyses of cores and water samples taken near Ault, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 6-B (corral):							
0-0.2	CL	5.7	--	340	84	0.16	990
0.2-0.5	CL	6.1	--	380	110	.00	60
0.5-1	CL	12.2	--	390	120	.19	32
1-1.5	CL	9.1	--	400	80	.14	20
1.5-2	GS	3.5	--	410	21	.08	2
2-3	GS	2.1	--	--	9	.00	2
3-4	GS	1.3	--	330	5	.00	24
4-5	GS	0.9	--	350	1	.04	2
5-6	GS	0.7	--	370	3	.00	2
6-7	GS	0.8	--	340	2	.01	2
7-8	GS	2.2	--	370	4	.01	8
8-9	GS	1.1	--	360	1	.00	0
Core 6-C (corral):							
0-0.2	M	8.5	--	130	0	.32	2,500
0.2-0.4	CL	15.9	--	250	61	3.9	390
0.4-0.7	CL	23.1	--	310	430	.09	3
0.7-1.5	CL	19.5	--	340	400	.20	19
1.5-2	CL	24.4	--	370	660	.15	2
2-3	CL	11.6	2.1	--	270	.04	9
3-4	CL	13.6	--	380	390	.01	1
4-5	CL	17.2	--	380	270	.00	0
5-6	GS	3.8	--	380	180	.01	8
6-7	GS	2.4	--	380	100	.02	1
7-8	GS	4.0	--	360	220	.04	1
8-9	GS	2.3	--	370	140	.06	1
9-10	GS	1.5	--	370	75	.03	3
10-11	GS	2.0	--	380	75	.01	4
11-12	GS	2.9	--	380	14	.02	0
12-13	GS	2.5	--	400	10	.02	1
13-14	GS	2.7	--	400	4	.04	0
14-15	GS	11.5	--	390	2	.00	0
15-16	GS	22.3	--	400	1	.02	3
Water sample				380	16	.28	2

Contd.

Table 12.--Location 6: Chemical and physical analyses of cores and water samples taken near Ault, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 6-D (Corral):							
0-0.2	CL	18.0	--	390	--	0.23	1
0.2-0.5	CL	13.9	--	390	48	.14	62
0.5-1	CL	14.2	--	400	53	.00	0
1-1.5	CL	11.7	--	410	--	.02	0
1.5-2	GS	4.0	--	410	30	.04	0
2-3	GS	2.4	--	410	11	.04	2
3-4	GS	1.8	--	390	9	.03	1
4-5	GS	1.7	--	330	6	.01	0
5-6	GS	1.7	--	330	6	.01	0
6-7	GS	1.8	--	370	--	.00	1
7-8	GS	1.9	--	370	--	.00	1
8-9	GS	1.2	--	390	--	.00	1
9-10	GS	2.9	--	320	12	.00	1
10-11	GS	2.0	--	370	6	.00	0
11-12	GS	2.5	--	390	4	.00	0
12-13	GS	2.3	--	390	--	.01	1
13-14	GS	8.0	--	400	1	.06	3
14-15	GS	10.1	--	400	0	.01	0
15-16	GS	12.5	--	380	1	.01	0
Water sample				420	11	.23	.8
Core 6-E (Irrigated alfalfa):							
0-0.5	CL	14.4	--	460	19	.02	0
0.5-1	CL	19.6	--	480	13	.36	18
1-1.5	CL	19.4	--	470	8	.20	21
1.5-2	CL	19.5	--	460	4	.07	1
2-3	CL	15.5	--	--	3	.04	2
3-4	CL	29.0	--	480	3	.01	2
4-5	CL	17.3	--	470	4	.00	0
5-6	GS	6.5	--	--	0	.02	0

Contd.

Table 12.--Location 6: Chemical and physical analyses of cores and water samples taken near Ault, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 6-E (contd.)							
6-7	GS	3.3	--	410	0	0.03	0
7-8	GS	4.4	--	430	0	.01	0
8-9	GS	3.3	--	420	0	.00	4
9-10	GS	2.7	--	410	0	.00	4
10-11	GS	2.4	--	390	0	.03	3
11-12	GS	2.6	--	400	1	.00	0
12-13	GS	3.0	--	440	0	.00	0
13-14	GS	6.2	--	403	1	.01	2
14-15	GS	8.3	--	360	1	.00	0
15-16	GS	9.5	--	380	1	.00	1
16-17	GS	12.2	--	320	1	.00	6
Water sample				-10	8.8	.83	.4
Core 6-F (Irrigated alfalfa):							
0-0.5	CL	23.8	--	470	6	.12	2
0.5-1	CL	22.8	--	490	1	.26	0
1-1.15	CL	24.1	--	490	3	.05	8
1.5-2	CL	22.8	--	490	2	--	1
2-3	CL	23.3	--	490	1	.01	23
3-4	CL-G	12.3	--	490	0	.00	1
4-5	GS	5.4	--	490	0	.00	3
5-6	GS	3.3	--	430	1	.00	1
6-7	GS	4.3	--	390	0	.01	2
7-8	GS	3.9	--	410	0	.04	1
8-9	GS	3.4	--	400	0	.01	2
9-10	GS	2.7	--	410	0	.00	4
10-11	GS	2.2	--	420	0	.01	1
11-12	GS	1.9	--	350	0	.01	1
12-13	GS	5.5	--	420	0	.01	5
13-14	GS	5.0	--	410	0	.01	1

Contd.

Table 12.--Location 6: Chemical and physical analyses of cores and water samples taken near Ault, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 6-F (contd.):							
14-15	GS	8.3	--	390	0	0.02	0
15-16	GS	12.9	--	400	2	.01	1
16-17	GS	10.7	--	420	1	.02	1
17-18	GS	9.7	--	370	0	.01	1
Water sample				360	9.8	.21	.9
Core 6-G (Nonirrigated sod):							
0-0.5	CL	15.4	--	470	6	.70	1
0.5-1	CL	3.9	--	480	1	.22	1
1-1.5	CL	15.5	--	490	0	1.7	0
1.5-2	CL	17.0	--	500	1	.19	1
2-3	CL	14.2	1.0	--	1	.07	2
3-4	SiC	12.5	--	430	0	.07	1
4-5	CL	20.4	--	450	0	.05	1
5-6	SCL	8.4	.8	--	1	.02	1
6-7	GS	1.9	--	400	0	.04	0
7-8	GS	0.7	--	400	1	.00	1
8-9	GS	0.7	--	250	0	.01	1
9-10	GS	1.2	--	270	0	.00	1
10-11	GS	1.0	--	280	0	.02	1
11-12	GS	1.1	--	290	0	.02	1
12-13	GS	1.1	--	340	0	.01	0
13-14	S	7.9	4.5	310	1	.01	0
14-15	S-C	8.1	--	320	1	.02	1
15-16	S-C	5.9	--	320	0	.00	3
16-17	S-C	7.9	--	320	0	.02	1
17-18	S-C	8.7	--	360	1	.01	1
18-19	GS	10.7	--	350	0	.01	3
Water sample				200	10	.09	0

Location No. 7

General Location: Across the road from the Great Western Sugar Company factory located at the east edge of Eaton, Colo.

General Remarks:

Soils: Colby loam Slope: 0-1 pct.

Corrals: The corrals range in age from 5 to 25 years. Cores C and D were obtained from 5-year-old corrals, whereas E and F were obtained from 15- and 25-year-old corrals (fig. 19). Approximately 300 cattle are present in the corrals continuously. The largest pen generally contains about 125 head, and the others contain from 75 to 100 head each. The pens are cleaned in the spring, and the manure is spread on the fields.

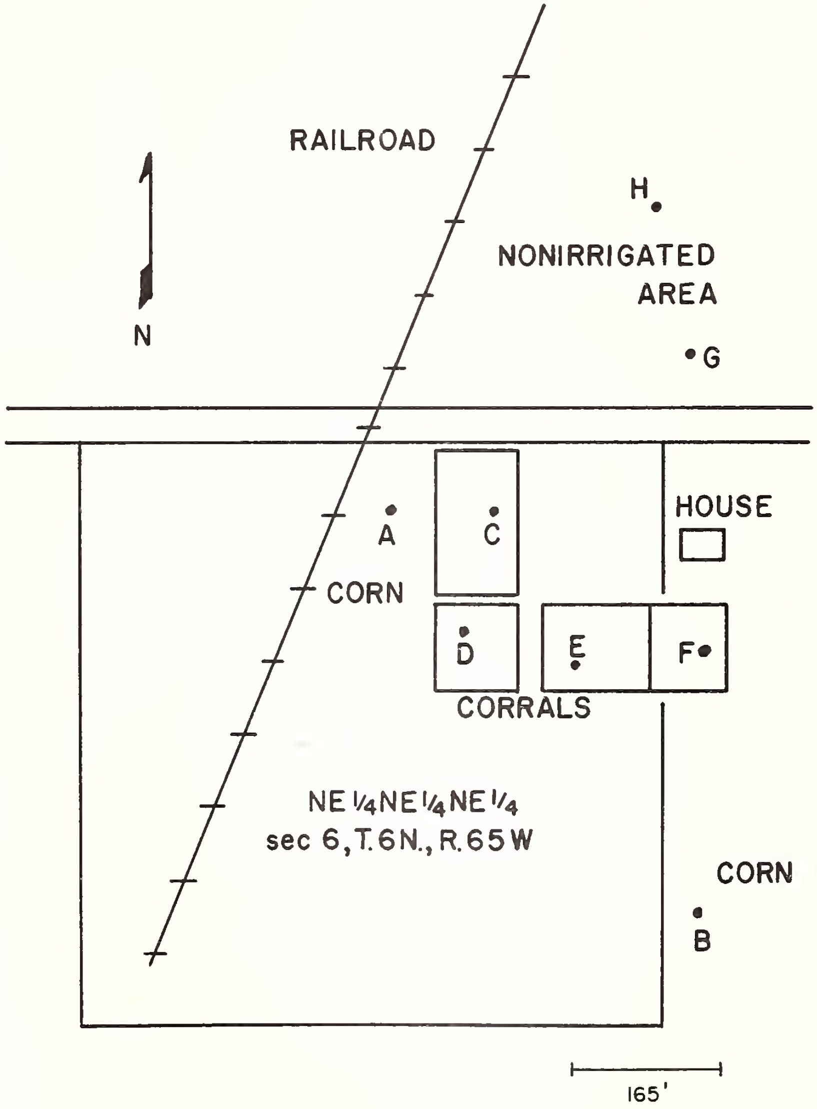


Figure 19.--Location 7 and core sites, near Eaton, Colo.

Irrigated Fields: A rotation system consisting of alfalfa, potatoes, beets, and corn is followed. Cores A and B were obtained from a field planted to corn that had not been in alfalfa for several years.

Nonirrigated area: Cores G and H were obtained from wasteland surrounding the sugar factory. This area has never been farmed, but its past management is unknown.

Fertilizer Practices: Manure is used on the fields at the rate of 20 tons per acre. The manure is generally applied to fields to be planted to corn. Commercial fertilizer is added to furnish 80 pounds of N per acre for corn and 30 pounds of N per acre for beets.

Water Quality: The domestic well is no longer used for drinking water for either humans or cattle. The farmer had the water tested, and the results indicated that it was suitable for livestock, but not for humans. However, the water had a bad odor and the cattle apparently objected to it, so the farmer switched to water supplied by the water district.

Significant findings:

The amounts of nitrate found in the core samples varied considerably according to the use made of the area from where they were taken. The corral cores, 7-C, 7-D, 7-E, and 7-F, contained much higher concentrations of nitrate than the cores from the irrigated or nonirrigated areas (table 13). However, even among the various corral cores, marked differences occurred. These differences were apparently effected by the respective age of each corral. The newer corrals, represented by cores 7-C and 7-D, contained high concentrations of nitrates in the first few feet, but the concentrations decreased rapidly with depth. Core 7-F, taken from the 25-year-old corral, had large amounts of nitrates to a depth of 16 feet, and then showed smaller amounts at the lower depths. The decrease in nitrate concentration at 16 feet corresponds to a texture change and a much lower water percentage in the soil.

Table 13.--Location 7: Chemical and physical analyses of cores and water samples taken near Eaton, Colo., 1966

Core, depth (ft.) and water sample	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 7-A (irrigated field):							
0-0.5	SiL	8.6	--	470	74	0.04	1
0.5-1	SiL	10.8	--	520	18	.01	2
1-1.5	SiL	12.9	--	500	5	.01	4
1.5-2	SiL	13.1	--	500	4	.04	3
2-3	SiL	7.4	3.3	--	3	.01	1
3-4	SiL	10.3	--	450	3	.01	2
4-5	SiL	13.1	--	450	0	.01	1
5-6	SL	7.1	14	--	0	.04	1
6-7	SL	10.5	--	450	2	.02	2
7-8	SL-G	5.5	--	450	0	.00	2
8-9	SL-G	3.4	.5	--	2	.01	0
9-10	SL-G	6.5	--	440	3	.01	3
10-11	SL-G	11.6	--	490	1	.01	4
11-12	SL-G	8.5	--	460	1	.00	1
12-13	SL	13.5	--	510	3	.00	5
13-14	S	3.4	7.2	--	3	.02	1
14-15	S	8.2	--	460	3	.00	1
15-16	L	9.0	--	500	3	.00	1
16-17	L	8.7	--	500	2	.01	2
17-18	L	9.1	--	500	2	--	--
18-19	GS	1.1	--	400	3	.01	1
19-20	GS	2.5	--	410	2	.00	1
20-21	GS	1.5	--	410	2	.01	2
21-22	G	1.1	--	420	0	--	1
22-23	--	--	--	--	--	--	--
23-24	C-G	7.3	--	420	3	.02	2
24-25	GS	4.9	--	430	7	.02	1
25-26	--	--	--	--	--	--	--
26-27	G	1.1	--	420	3	--	1
27-34	G	2.5	--	420	1	.01	1
34-35	G	.8	--	440	5	.02	1

1/ See table 1 for texture symbols.
Contd.

Table 13.--Location 7: Chemical and physical analyses of cores and water samples taken near Eaton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 7-B (irrigated field):							
0-0.5	SiL	17.8	--	420	59	0.09	2
0.5-1	SiL	14.0	--	490	26	.05	1
1-1.5	SiL	12.1	--	420	2	.01	1
1.5-2	SiL	11.4	--	420	0	.00	1
2-3	SiL	13.1	.5	--	5	.06	6
3-4	SiL	13.7	--	430	1	.00	0
4-5	SiL	15.5	--	450	1	.00	0
5-6	L	14.9	10	--	4	.00	0
6-7	L	12.0	--	420	10	.00	0
7-8	L	13.3	--	440	11	.00	0
8-9	SiCL	21.8	9.3	--	7	.00	0
9-10	SiCL	18.0	--	420	2	.00	1
10-11	L	13.5	--	480	1	.00	1
11-12	L	13.9	--	400	2	.00	1
12-13	GS	10.3	--	400	2	.00	1
13-14	GS	9.3	18	--	2	.00	0
14-15	GS	7.6	--	380	1	.00	0
15-16	S	4.9	--	400	1	.00	1
16-17	S	12.1	--	390	2	.00	1
17-18	S	5.3	--	430	0	.00	1
18-19	S	4.1	--	380	1	.01	2
19-20	S	5.0	--	380	--	.00	0
20-21	G	3.3	--	370	0	.00	0
21-22	S	6.5	--	400	1	.00	1
22-23	S	3.8	--	420	0	.00	1
23-24	S	3.2	--	340	0	.00	1
24-25	G	4.0	--	350	1	.00	1
25-26	G-SC	8.4	--	390	1	.00	0
26-27	G-SC	5.9	--	340	1	.00	1
27-28	G-SC	10.2	--	350	1	.00	1
28-29	G-SC	12.1	--	310	1	.00	1
29-30	G-SC	11.5	--	330	1	.00	1
Water sample				300	.1	.17	0

Contd.

Table 13.--Location 7: Chemical and physical analyses of cores and water samples taken near Eaton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 7-C (corral):							
0-0.2	SiL	9.7	--	400	95	0.83	540
0.2-0.5	SiL	7.0	--	550	230	.89	240
0.5-1	SiL	9.9	--	530	130	.21	--
1-1.5	SiL	15.8	--	460	58	.24	1
1.5-2	SiL	13.8	--	460	21	.37	1
2-3	SiL	10.9	4.0	--	--	.03	4
3-4	SiL	10.3	--	440	2	.05	1
4-5	SiL	13.8	--	460	2	.04	1
5-6	SiL	13.5	1.5	--	--	.00	1
6-7	L	11.1	--	450	0	.03	1
7-8	L	10.8	--	480	0	.03	3
8-9	L	17.0	1.4	--	--	.00	--
9-10	L	18.0	--	430	1	.01	1
10-11	L	17.1	--	460	1	.01	1
11-12	L	15.8	2.8	--	--	.00	1
12-13	L	16.2	--	400	2	.03	4
13-14	L	12.8	--	400	0	.03	2
14-15	SL	13.0	--	390	0	.03	2
15-16	SL	15.7	--	460	0	.02	2
16-17	G	7.1	6.4	--	1	.00	1
17-18	G	4.5	--	400	1	.05	7
18-19	G	1.9	--	360	1	.02	1
19-20	G	--	--	420	0	.01	1
20-21	SiL	12.6	--	410	5	.07	8
21-22	SiCL	22.9	--	-50	1	.03	2
22-23	SL	13.0	--	390	1	.04	11
23-24	SL	14.5	--	440	3	.01	--
24-25	G-CL	12.7	--	390	1	.05	2
25-26	CL	23.2	--	400	3	.04	6
26-28	CL	--	--	--	--	--	--
28-29	CL	16.9	--	380	1	.08	11
29-30	CL	28.2	--	370	0	--	2
30-31	CL	22.5	--	450	2	.01	--
31-32	C	24.1	--	460	0	.02	2
32-33	--	--	--	180	0	.35	3
33-34	S	21.7	--	380	0	.01	0

Table 13.--Location 7: Chemical and physical analyses of cores and water samples taken near Eaton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 7-D (corral):							
0-0.2	M	53.4	--	410	13	0.05	3,860
0.2-0.5	SiL	21.5	--	340	100	9.9	100
0.5-0.8	SiL	23.7	--	380	100	.12	25
0.8-1.5	SiL	18.5	--	390	150	.09	2
1.5-2	SiL	16.6	--	380	53	.06	3
2-3	SiL	--	.2	--	5	.15	5
3-4	SiL	13.7	--	420	2	.02	0
4-5	SiL	13.4	--	430	3	.00	0
5-6	SiL	10.8	2.6	--	4	.04	2
6-7	SiL	14.1	--	430	6	.01	1
7-8	SiL	14.6	--	440	6	.00	1
8-9	SiL	11.6	7.5	--	7	.02	1
9-10	SiL	26.0	--	430	6	--	--
10-11	SiL	20.9	--	470	5	.00	1
11-12	SiL	19.9	--	480	1	.02	2
12-13	S	10.0	--	480	2	.00	1
13-14	GS	5.4	.4	--	0	.01	1
14-15	GS	7.9	--	470	1	.01	1
15-16	S	6.8	--	470	2	.00	0
16-17	S	6.9	--	430	2	.01	1
17-18	S	8.0	--	440	0	.00	3
18-19	S	6.3	--	380	1	.01	2
19-20	S	9.8	--	380	2	.00	1
20-21	S-SiC	15.1	--	410	3	.00	0
21-22	S-SiC	12.6	--	420	4	.00	1
22-23	S	6.0	--	400	1	.00	1
23-24	S	5.0	--	410	--	--	1
24-25	S	7.9	--	390	2	.01	2
25-26	S	15.9	--	390	0	.00	3
26-27	S-Si	11.2	--	380	0	.00	1
27-28	S-Si	13.9	--	380	0	.00	0
28-29	S-Si	8.9	--	420	4	.05	2
29-30	S	15.1	--	390	3	.00	1

Contd.

Table 13.--Location 7: Chemical and physical analyses of cores and water samples taken near Eaton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 7-D (contd.):							
30-31	S	12.8	--	340	2	0.58	7
31-32	S	19.1	--	--	--	.00	1
32-33	S	14.1	--	--	--	.02	1
33-34	S	12.9	--	370	2	.01	0
Water sample				250	13.0	0.10	0.5
Core 7-E (corral):							
0-0.2	SiL	20.9	--	330	83	.97	174
0.2-0.5	SiL	22.8	--	410	290	.07	10
0.5-1	SiL	20.7	--	420	310	.12	2
1-1.5	SiL	21.6	--	420	140	.08	1
1.5-2	SiL	16.3	--	430	66	.06	2
2-3	SiL	12.5	14	--	30	.05	3
3-4	SiL	16.2	--	470	12	.01	0
4-5	SiL	16.4	--	440	9	.02	1
5-6	SiL	13.8	.7	--	7	.02	2
6-7	SL	17.2	--	510	5	.00	0
7-8	SL	19.8	--	470	5	.00	1
8-9	SL	17.6	.3	--	4	.01	1
9-10	SL	17.7	--	480	2	.02	0
10-11	SL	15.2	--	450	2	.00	0
11-12	SL	19.7	--	460	1	.00	1
12-13	S	11.0	--	450	2	.00	1
13-14	GS	5.9	2.3	460	1	.00	1
14-15	GS	8.6	--	420	1	.00	0
15-16	GS	5.7	--	430	2	.00	1
16-17	GS	7.9	--	430	4	.02	2
17-18	GS	5.2	12	440	2	.00	1
18-19	GS	9.2	--	470	3	.01	2
19-20	GS	7.8	--	450	2	.00	1
20-21	GS	4.8	--	460	3	.00	4
21-22	GS	9.9	--	460	2	.00	1

Contd.

Table 13.--Location 7: Chemical and physical analyses of cores and water samples taken near Eaton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 7-E (contd.):							
22-23	S-C	12.5	--	330	6	0.00	2
23-24	GS	14.6	--	380	3	.02	1
24-25	S	5.3	--	430	3	.00	3
25-26	S	12.8	--	450	0	.00	2
26-27	GS	7.2	--	420	2	.00	3
27-28	GS	6.9	--	420	1	.00	1
28-29	GS	9.6	--	290	1	.00	6
29-30	S	20.7	--	360	2	.00	1
30-31	S	14.9	--	330	1	.00	8
31-32	S	12.6	--	310	2	.00	1
32-33	S	14.5	--	300	2	.00	3
33-34	S	14.0	--	330	4	.00	2
Water sample				-344	8.6	.09	5.1
Core 7-F (corral):							
0-0.2	SiL	13.2	--	290	0	--	590
0.2-0.5	SiL	11.5	--	330	230	.64	270
0.5-1	SiL	11.5	--	350	230	.21	34
1-1.5	SiL	11.8	--	380	100	.00	2
1.5-2	SiL	9.7	--	380	43	.03	1
2-3	SiL	10.8	2.7	--	29	.41	42
3-4	SiL	12.3	--	410	54	.00	2
4-5	L	10.8	--	430	56	.03	3
5-6	L	10.3	3.9	--	44	.13	1
6-7	SiL	16.1	--	460	80	.02	3
7-8	L	17.2	--	430	56	.00	1
8-9	L	14.0	1.2	--	36	.00	1
9-10	L	11.9	--	460	35	.00	1
10-11	SL	10.1	--	460	31	.00	0
11-12	SL	9.5	--	440	28	.00	1
12-13	SL	12.3	--	440	41	.00	2
13-14	SiCL	15.3	13	--	33	.01	1

Contd.

Table 13.--Location 7: Chemical and physical analyses of cores and water samples taken near Eaton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core-F (contd.):							
14-15	SCL	10.0	--	430	21	0.02	3
15-16	L	15.0	--	420	30	.00	3
16-17	GS	5.4	--	420	7	.00	1
17-18	GS	4.7	--	420	5	.00	1
18-19	GS	2.1	--	410	2	.00	3
19-20	GS	1.8	--	420	3	.00	2
20-21	SL	9.8	--	440	4	.00	1
21-22	SL	4.6	--	420	0	.00	2
22-23	G	3.2	--	440	0	.00	2
23-24	G	2.5	--	400	0	.00	1
24-25	G	3.0	--	420	0	.00	2
25-26	G	2.6	--	390	0	.00	1
26-27	G	4.7	--	380	0	.00	1
27-28	G	2.8	--	380	0	.00	2
28-29	G	6.8	--	390	0	.00	2
29-30	G	7.5	--	370	1	.00	3
30-31	SiCL	18.5	--	360	1	.01	2
31-32	SiCL	10.7	--	180	1	.00	2
32-33	SiCL	15.0	--	290	0	.00	1
Core 7-G (nonirrigated sod):							
0-0.5	SiL	9.1	--	460	9	--	2
0.5-1	SiL	10.4	--	410	5	.00	1
1-1.5	SiL	8.3	--	430	2	.03	1
1.5-2	SiL	7.1	--	450	2	.02	2
2-3	SiL	8.2	.0	--	2	.04	1
3-4	SiL	9.1	--	400	3	.01	1
4-5	SiL	10.7	--	430	5	.01	1
5-6	L	19.7	.9	--	5	.01	2
6-7	L	10.3	--	370	5	.01	1
7-8	L	14.9	--	440	5	.02	1
8-9	L	14.0	.9	--	3	.01	1
9-10	L	12.7	--	400	4	.01	1

Contd.

Table 13.--Location 7: Chemical and physical analyses of cores and water samples taken near Eaton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 7-G (contd.):							
10-11	SL	7.3	--	440	2	0.01	1
11-12	SL	9.1	--	400	2	.00	3
12-13	S-C	17.4	--	460	3	.00	2
13-14	S	7.2	1.2	--	2	.00	1
14-15	S	8.1	--	400	2	.00	1
15-16	S-C	12.0	--	450	2	.01	1
16-17	S	10.6	--	430	3	.01	1
17-18	CL	16.8	--	470	4	.01	1
18-19	SCL	14.1	2.4	--	2	.01	1
19-20	SCL	9.1	--	420	2	.00	1
20-21	SCL	12.5	--	460	2	.00	2
21-22	SCL	15.5	--	440	2	.00	1
22-23	CL	19.0	--	450	3	.01	2
23-24	CL	22.4	1.4	--	2	.02	1
24-25	CL	24.1	--	440	4	.01	2
25-26	L	23.5	--	480	3	.00	1
26-27	CL	23.0	--	440	2	.00	2
27-28	CL	26.9	--	450	3	.01	2
28-29	S	20.2	--	490	1	.00	1
29-30	S	20.7	--	450	0	.00	1
30-31	S	19.5	--	370	1	.09	2
Water sample				350	17	.04	.1
Core 7-H (nonirrigated sod)							
0-0.5	SiL	9.6	--	410	4	.02	1
0.5-1	SiL	10.3	--	690	5	.01	1
1-1.5	SiL	9.7	--	520	8	.01	2
1.5-2	SiL	6.6	--	520	0	.07	1
2-3	SiL	5.7	1.4	--	23	--	4
3-4	SiL	7.1	--	420	7	.02	2
4-5	L	7.8	--	440	2	.01	1
5-6	L	7.9	1.4	--	1	.02	0

Contd.

Table 13.--Location 7: Chemical and physical analyses of cores and water samples taken near Eaton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 7-H (contd.):							
6-7	L	14.3	--	430	1	0.00	1
7-8	L	12.2	--	470	0	.00	1
8-9	L	16.6	.8	--	1	.01	1
9-10	L	14.1	--	440	0	.00	0
10-11	L	13.5	--	470	0	.01	1
11-12	L	12.5	--	450	1	.01	1
12-13	L	12.8	--	470	1	.02	1
13-14	L	12.6	4.2	--	0	.03	1
14-15	L	12.9	--	500	2	.00	1
15-16	L	14.8	--	570	3	.01	1
16-17	L	15.4	--	500	3	.00	1
17-18	L	14.4	--	450	2	.02	0
18-19	S	11.7	8	--	1	.00	1
19-20	S	9.7	--	440	1	.01	1
20-21	S	10.8	--	490	2	.01	1
21-22	S	8.1	--	450	1	.00	1
22-23	GS	4.0	--	480	0	.01	1
23-24	GS	2.0	--	480	0	.01	1
24-25	GS	3.1	--	490	0	.00	1
25-26	GS	2.4	--	490	0	.00	1
26-27	GS	9.7	--	520	1	.01	2
27-28	S	14.1	--	500	1	.01	2
28-29	S	9.1	--	410	1	.01	2
29-30	S	10.9	--	450	1	.01	2
30-31	S	11.6	--	370	1	.02	3
31-32	S	11.0	--	380	3	.00	2
32-33	S	13.0	--	350	2	.01	2
33-34	S	11.7	--	440	0	.01	2
Water sample				-320	19	.48	1.0

Location No. 8

General Location: 7 miles E., 1 mile N., and 1/3 mile E. of Lucerne, Colo.

General Remarks:

Soils: Core A - Otero sandy loam Slope: 3-5 pct.
Cores B, C, D, E, F, and G - Ascalon sandy loam Slope: 1-3 pct.

Corrals: The small corral is about 60 years old, and the large one is 30 years old (fig. 20). About 200 cattle are fed in the corrals annually. The manure is removed in the spring and spread on the fields.

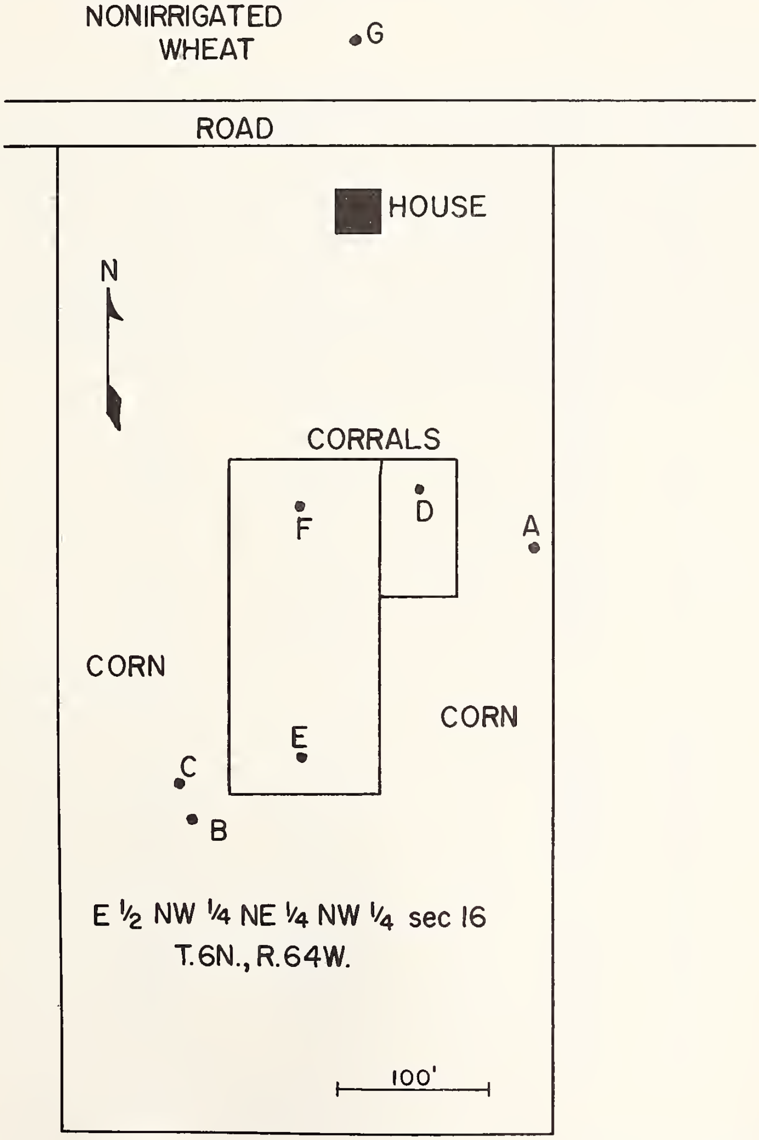


Figure 20.--Location 8 and core sites, near Lucerne, Colo.

Irrigated Fields: Alfalfa has not been grown in these fields for several years. Corn and sugar beets have been the principal crops grown in recent years.

Nonirrigated Field: The field has been in cultivation for approximately 50 years. A wheat-fallow system of farming is practiced.

Fertilizer Practices: Manure and commercial fertilizers are applied to the fields when corn or sugar beets are grown. However, the specific rates applied are not known. No fertilizer has been applied to the nonirrigated area.

Water Quality: The well is 300 feet deep, and the quality of the water is believed to be good.

Significant findings:

The concentration of nitrate was relatively high for all cores at this location with the exception of core 8-G, taken from the nonirrigated area (table 14). A possible explanation for the much higher than normal nitrate levels is that shale underlies this area at depths ranging from 6 to 20 feet. This layer probably prevents movement of water and nitrates out of the soil. The water table is quite deep at this location. The domestic water well is 300 feet deep but even so, the water supply is scarce. Some water was obtained at 16 feet, the level at which core 8-E was taken, but apparently it was a perched water table resulting from irrigation water.

Table 14.--Location 8: Chemical and physical analyses of cores and water sample taken near Lucerne, Colo., 1966

Core, depth (ft.) and water sample	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 8-A (irrigated field):							
0-0.5	L	7.8	--	590	59	0.15	1
0.5-1	L	8.0	--	570	69	.10	8
1-1.5	SL	7.0	--	530	72	.07	0
1.5-2	SL	4.7	--	540	31	.04	1
2-3	SL	4.9	--	--	26	.02	3
3-4	SL	9.3	--	490	50	.02	0
4-5	L	10.4	--	450	26	.00	0
5-6	L	17.6	2.5	--	19	.00	0
6-7	L	19.6	--	440	20	.01	1
7-8	L	16.6	--	450	11	.01	1
8-9	SiCL	18.8	32	--	2	.01	1
9-10	SiCL	18.6	--	430	2	.01	2
10-11	C-Sh	21.0	--	450	2	.01	0
11-12	C-Sh	21.4	--	500	6	.01	0
12-13	C-Sh	20.5	--	450	9	.01	0
13-14	C-Sh	25.6	30	--	15	.01	0
14-15	C-Sh	23.3	--	460	23	.04	0
15-16	C-Sh	22.9	--	440	15	.03	0
16-17	Sh	26.5	--	410	19	.04	0
Core 8-B (irrigated field):							
0-0.5	SL	7.9	--	470	88	.11	16
0.5-1	SL	8.0	--	480	110	.16	2
1-1.5	SL	8.7	--	480	7	.07	2
1.5-2	SL	9.8	--	490	43	.11	2
2-3	SL	11.9	6.3	--	31	.05	2
3-4	SiCL	19.3	--	450	16	.02	1
4-5	SiCL	20.7	--	450	12	.00	0
5-6	S	18.0	8.3	--	7	.01	0
6-7	S-Sst	17.1	--	430	15	.04	1

1/ See table 1 for texture symbols

Contd.

Table 14.--Location 8: Chemical and physical analyses of cores and water sample taken near Lucerne, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 8-C (irrigated field):							
0-0.5	SL	9.4	--	460	50	0.06	15
0.5-1	SL	10.7	--	470	14	.05	2
1-1.5	SL	8.9	--	490	11	.10	0
1.5-2	SL	9.6	--	490	23	.07	1
2-3	SL	15.9	2.5	--	22	.04	7
3-4	SL	13.5	--	440	8	.02	0
4-5	CL	19.6	--	440	8	.02	1
5-6	SL	19.8	13	--	7	.00	1
6-7	SL	19.0	--	390	9	.01	2
7-8	SL	19.5	--	430	8	.01	0
8-9	--	--	--	--	--	--	--
9-10	C-Sh	20.4	--	430	3	.01	0
10-11	C-Sh	21.1	--	450	4	.01	0
11-12	C	27.7	--	440	4	.02	1
12-13	C-Sh	20.4	--	470	1	.02	1
13-14	L-Sst	19.2	--	450	1	.01	0
Core 8-D (corral):							
0-0.2	SL-M	108.2	--	350	23	41	3
0.2-0.5	SL	10.1	--	360	4	.06	40
0.5-1	SL	9.2	--	370	1	.02	2
1-1.5	SL	11.7	--	390	140	.10	0
1.5-2	SL	11.3	--	400	27	.10	0
2-3	SL	10.4	18	--	12	.02	1
3-4	S	7.7	--	380	4	.02	0
4-5	S	5.0	--	420	3	.00	0
5-6	SL	5.3	3.2	--	6	.01	4
6-7	SL	6.5	--	360	6	.01	0
7-8	SL	8.6	--	360	12	.01	1
8-9	SL	7.6	10	--	2	.01	0
9-10	SL	7.2	--	360	3	.01	4

Contd.

Table 14.--Location 8: Chemical and physical analyses of cores and water sample taken near Lucerne, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 8-D (continued):							
10-11	S	9.0	--	380	14	0.01	4
11-12	S	9.9	--	380	28	.03	4
12-13	SL	21.6	--	380	45	.02	0
13-14	C-Sh	21.1	3.3	--	22	.02	5
14-15	C-S	18.3	--	390	16	0.19	1
15-16	C-S	22.6	--	380	14	.01	0
16-17	C-Sh	19.8	--	330	12	.01	2
Core 8-E (corral):							
0-0.2	M	58.7	--	90	6	1.2	360
0.2-0.5	SL	9.4	--	290	4	5.2	920
0.5-1	SL	5.2	--	330	98	23	33
1-1.5	SL	10.7	--	340	39	.04	18
1.5-2	SL	11.5	--	350	33	.20	2
2-3	SL	11.4	1.0	--	50	.14	1
3-4	SL	13.3	--	380	62	.24	2
4-5	SL	10.0	--	390	38	.01	0
5-6	SL	13.2	3.1	--	28	.07	0
6-7	SL	15.3	--	410	24	.06	0
7-8	CL	20.8	--	430	14	.04	2
8-9	C-Sh	20.5	2.5	--	8	.06	4
9-10	C	20.6	--	430	11	.01	2
10-11	C	23.5	--	470	11	.01	0
11-12	C	22.5	--	450	14	.01	0
12-13	C	22.7	--	490	23	.01	1
13-14	C	20.4	.6	--	16	.39	0
14-15	S	18.8	--	450	13	.25	0
15-16	S	22.4	--	410	13	.08	0
16-17	S-Sst	19.6	--	390	15	.07	1
Water sample				436	61	.10	.1

Contd.

Table 14.--Location 8: Chemical and physical analyses of cores and water sample taken near Lucerne, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 8-F (corral):							
0-0.2	M	48.7	--	170	4	1.4	70
0.2-0.5	SL	9.1	--	230	5	.16	15
0.5-1	SL	10.0	--	300	0	.28	70
1-1.5	SL	9.6	--	320	11	.33	2
1.5-2	SL	9.7	--	340	43	.01	6
2-3	SL	11.2	1.2	--	--	.01	1
3-4	SL	14.7	--	390	62	.01	2
4-5	CL	20.7	--	410	96	.08	1
5-6	SL	11.1	1.5	--	55	.04	1
6-7	SL	8.8	--	410	45	.04	0
7-8	SL	5.1	--	410	31	.07	1
8-9	G	5.9	--	430	18	.05	1
9-10	SL	5.3	--	430	21	.02	0
10-11	SL	14.8	--	410	51	.14	0
11-12	SL	13.7	--	430	45	.11	1
12-13	SL-Sh	15.4	--	420	30	.04	1
13-14	SL-Sh	16.0	--	400	12	.02	1
14-15	SL	21.7	--	430	18	.02	2
15-16	C-Sh	22.0	--	440	16	.03	4
16-17	C-Sh	6.7	1.3	--	17	.10	1
17-18	C-Sh	22.4	--	430	13	.02	1

Contd.

Table 14.--Location 8: Chemical and physical analyses of cores and water sample taken near Lucerne, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 8-G (nonirrigated cultivated field):							
0-0.5	SL	4.6	--	540	2	0.00	1
0.5-1	SL	5.9	--	490	8	.08	1
1-1.5	SL	5.1	--	540	4	.04	1
1.5-2	SL	5.0	--	540	2	.01	1
2-3	SL	4.7	0	--	0	.05	--
3-5	C-Sh	4.6	--	390	0	.01	--
5-6	SiCL	20.0	--	330	2	.00	3
6-7	CL	21.4	1.3	--	1	.00	0
7-8	CL	21.7	--	340	1	.00	2
8-9	CL	21.9	--	340	0	.01	1
9-10	CL	21.1	.2	--	1	.01	3
10-11	CL	21.6	--	370	2	.00	3
11-12	SiC	23.2	--	420	3	.00	1
12-13	SiC	23.6	--	330	3	.04	1
13-14	C-Sh	14.9	--	420	1	.04	2

Location No. 9

General Location: 2-^{1}/2 miles E. of Peckham, Colo.

General Remarks:

Soils: Core A - Vona loamy sand Slope: 1-3 pct.
Cores B, C, D, E, F, G, H, I, and J - Olney sandy loam Slope: 0-1 pct.
Cores K and L - Ascalon sandy loam Slope: 1-3 pct.

Corrals: The corrals range in age from 4 to 30 years. Cores D and E, F and G, and H and I were taken from 4-, 15-, and 30-year-old corrals, respectively (fig. 21). Approximately 250 to 300 cattle are fed in each of the corrals. The corrals are used continuously, and the manure is removed in the spring and fall. A part of the manure is spread on the fields, and the rest is sold to neighboring farms.

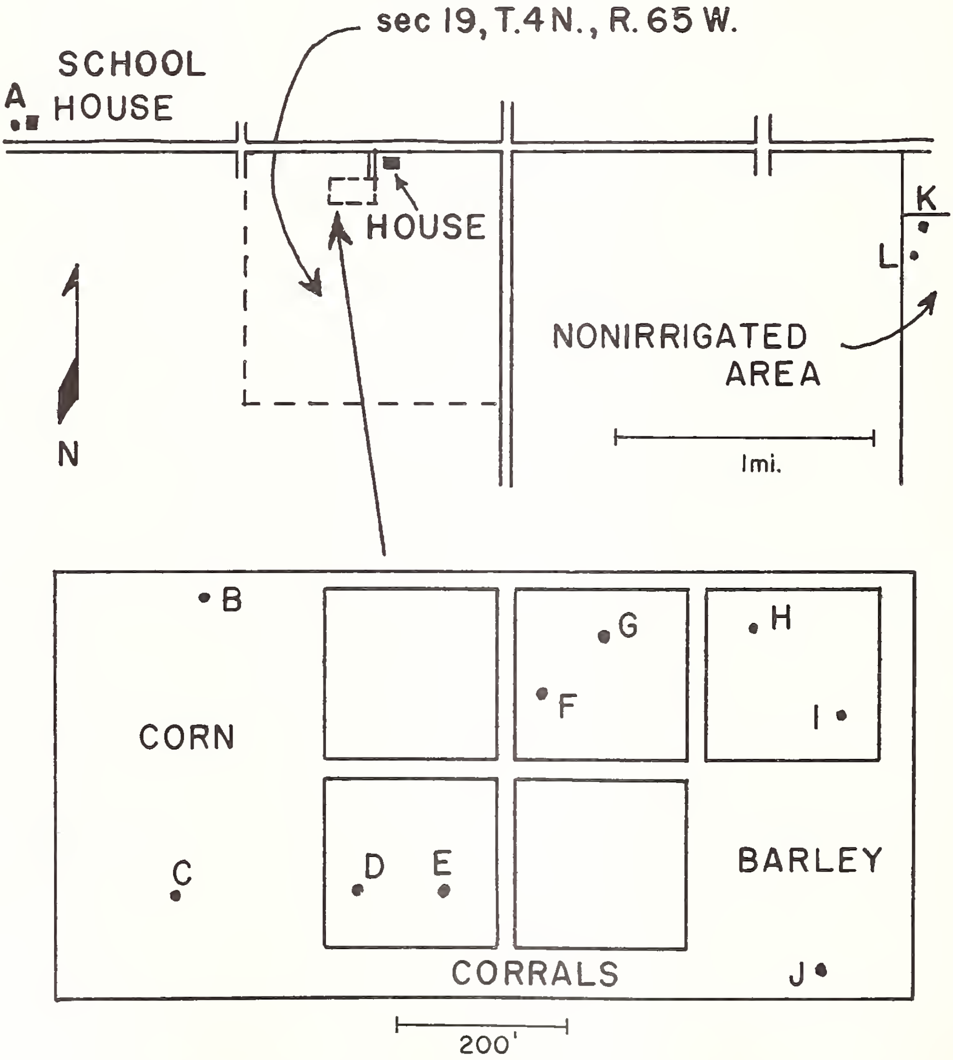


Figure 21.--Location 9 and core sites, near Peckham, Colo.

Irrigated Fields: A rotation of alfalfa (3 to 4 years), potatoes (1 year), beets (1 year), and corn (1 to 2 years) is generally followed. However, cores B, C, and J were obtained from areas where alfalfa had not been grown since 1957. The area where cores B and C were taken has now been utilized for additional corrals.

Nonirrigated Areas: Core A was taken in the play area surrounding the schoolhouse. The area has never been plowed. Cores K and L were obtained from a fallow wheatfield cultivated for about 50 years.

Fertilizer Practices: Manure at the rate of 15 tons per acre is applied on the fields when beets or corn are grown. In addition, commercial fertilizers are used to furnish additional N and P_2O_5. As far as could be determined, no fertilizers had ever been applied to the dryland wheatfield or to the area surrounding the schoolhouse.

Water Quality: The last test of the water made by the farmer showed 2 p.p.m. NO_3-N. The water is used for livestock and domestic purposes, although drinking water for humans is usually hauled in because, the farmer stated, the well water has a bad taste. Samples of the well water obtained during this study showed 15 p.p.m. of NO_3-N, an amount unsuitable for human consumption according to the standards set by the U.S. Public Health Service.

Significant findings:

The nitrate amounts found in the cores from the corrals are quite varied and appear to be related to the age of the corrals. Cores 9-H and 9-I, taken from the oldest corral, had by far the highest concentrations of nitrate (table 15). The ammonium and nitrite levels were also higher in the cores obtained from the oldest corral. Cores from the irrigated fields also had substantial amounts of nitrate, but the cores from the nonirrigated areas were quite low in nitrate. There were distinct differences in the ammonium concentration of the water samples, and these will be discussed further in the section of the report dealing with water analyses.

Table 15.--Location 9: Chemical and physical analyses of cores and water samples taken near Peckham, Colo., 1966

Core, depth (ft.) and water sample	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 9-A (nonirrigated sod):							
0-0.5	SL	3.6	--	430	0	0.00	1
0.5-1	SL	4.4	--	450	0	.00	2
1-1.5	SL	3.9	--	470	0	.00	0
1.5-2	LS	3.5	--	480	0	.00	1
2-3	S	4.0	0.4	--	0	.00	2
3-4	S	4.4	--	430	0	.00	1
4-5	S	6.5	--	430	0	.00	2
5-6	S	3.9	10.4	--	0	.00	1
6-7	S	4.6	--	420	0	.00	1
7-8	S	4.2	--	410	0	.00	1
8-9	S	3.4	8	--	0	.00	3
9-10	S	3.8	--	410	0	.00	0
10-11	S	3.4	--	420	0	.00	1
11-12	S	3.3	--	430	0	.00	0
12-13	S	3.2	--	430	0	.00	0
13-14	S	3.7	2.4	--	0	.00	2
14-15	S	4.3	--	380	0	.00	2
15-16	S	4.0	--	390	0	.00	1
16-17	S	3.8	--	370	0	.00	0
17-18	S	7.0	--	400	0	.00	2
18-19	S	8.4	1.9	--	0	.00	2
19-20	S-CL	6.8	--	380	0	.00	2
20-21	S-CL	6.9	--	330	0	.00	0
21-22	S-CL	6.4	--	390	0	.00	2
22-23	S-CL	14.7	--	380	1	.00	0
23-24	S-CL	16.5	--	450	1	.00	0
24-25	SCL	13.0	--	430	1	.00	2
25-26	SCL	13.6	--	430	1	.00	2
26-27	SCL	12.7	--	470	1	.00	0
27-28	SCL	17.9	--	470	1	.00	1
28-29	S	15.6	--	490	0	.00	3
29-30	S	13.5	--	480	1	.00	2
30-31	S	13.5	--	290	1	.00	1
Water sample				-330	10	.22	.3

1/ See table 1 for texture symbols.

Contd.

Table 15.--Location 9: Chemical and physical analyses of cores and water samples taken near Peckham, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 9-B (irrigated field):							
0-0.5	SCL	11.4	--	520	230	0.16	3
0.5-1	SCL	15.5	--	500	83	2.6	10
1-1.5	SCL	12.8	--	480	38	.03	0
1.5-2	SCL	14.6	--	480	40	.05	2
2-3	SCL	15.8	4.5	--	11	.02	1
3-4	SiC	18.8	--	480	8	.02	1
4-5	SC	16.2	--	450	3	.00	3
5-6	C	17.6	7.5	--	1	.03	1
6-7	C	20.2	--	460	1	.02	2
7-8	SC	17.5	--	470	1	.00	2
8-9	SC	17.1	4.2	--	0	.03	0
9-10	SC	15.9	--	450	1	.07	1
10-11	SC	16.2	--	480	3	.00	1
Water sample				360	14	.24	.1
Core 9-C (irrigated field):							
0-0.5	SCL	12.1	--	430	76	.05	0
0.5-1	SCL	13.8	--	450	29	.03	5
1-1.5	SCL	13.2	--	450	8	.01	2
1.5-2	SCL	16.3	--	470	5	.00	1
2-3	SCL	12.0	4.0	--	4	.01	4
3-4	SCL	14.5	--	450	3	.03	0
4-5	SCL	19.1	--	480	6	.00	1
5-6	CL	24.8	1.8	--	9	.00	5
6-7	CL	20.1	--	480	5	.00	0
7-8	S	17.8	--	480	5	.01	5
8-9	S	18.6	--	320	5	.03	1
9-10	C	17.2	--	440	1	.01	2
Water sample				360	31	.09	.1

Contd.

Table 15.--Location 9: Chemical and physical analyses of cores and water samples taken near Peckham, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	E	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 9-D (corral):							
0-0.5	M	27.4	--	180	0	0.25	4,500
0.5-0.7	SCL	8.4	--	230	7	.09	900
0.7-1	SCL	10.8	--	260	3	.01	220
1-1.5	SCL	14.5	--	300	0	.00	21
1.5-2	SCL	17.3	--	330	0	.00	9
2-3	SCL	17.6	15	--	0	.01	3
3-4	SiC	16.0	--	380	1	.01	2
4-5	SL	13.5	--	420	0	.00	3
5-6	CL	17.9	2.5	--	0	.00	2
6-7	SiCL	16.7	--	420	0	.01	1
7-8	SL	18.0	--	430	0	.02	3
8-9	SL	16.8	--	420	0	.01	5
9-10	S	17.4	--	430	0	.02	0
10-11	S	16.5	--	420	2	.01	0
Water sample				260	8.5	.20	.8
Core 9-E (corral):							
0-0.1	M	11.6	--	350	0	.28	3,400
0.1-0.3	SCL	3.9	--	320	7	.02	1,100
0.3-0.5	SCL	5.3	--	370	41	1.6	820
0.5-1	SCL	7.9	--	420	75	1.2	29
1-1.5	SCL	10.0	--	420	19	.26	8
1.5-2	SCL	13.5	--	400	8	.31	10
2-3	SCL	12.3	.5	--	2	.01	1
3-4	SCL	17.2	--	420	2	.04	2
4-5	SCL	13.7	--	440	1	.02	4
5-6	SCL	12.4	5.0	--	1	.03	4
6-7	SCL	11.4	--	310	0	.00	5
7-8	SiCL	16.4	--	370	1	.03	0
8-9	SiCL	16.1	--	--	2	.01	0
9-10	SiCL	14.6	--	420	2	.00	2
10-11	S	13.5	--	310	0	.12	0
11-12	S	16.3	--	370	0	.07	2
Water sample				340	21	5.7	5.8

Contd.

Table 15.--Location 9: Chemical and physical analyses of cores and water samples taken near Peckham, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 9-F (corral):							
0-0.2	M	29.3	--	150	0	0.09	2,700
0.2-0.5	SCL	18.2	--	180	0	.08	1,300
0.5-1	SCL	15.3	--	270	0	.00	420
1-1.5	SCL	10.7	--	310	0	.04	48
1.5-2	SCL	11.4	--	320	0	.01	2
2-3	SCL	8.2	--	--	0	.03	2
3-4	SL	8.0	--	350	0	.00	13
4-5	SL	5.8	--	390	2	.00	2
5-6	SL	6.1	1.3	--	1	.01	2
6-7	SL	7.5	--	400	1	.00	8
7-8	SL	11.2	--	420	1	.01	1
8-9	SCL	14.0	42	--	2	.02	3
9-10	SCL	11.4	--	340	1	.00	3
10-11	L	16.7	--	400	5	.01	2
11-12	L	18.8	--	-20	3	.00	3
12-13	C	16.2	--	240	2	.00	0
13-14	C	21.3	--	290	6	.01	2
Water sample				-310	18	.04	5.7
Core 9-G (corral):							
0-0.2	M	16.4	--	410	2	.08	2,000
0.2-0.5	SCL	17.5	--	320	0	.06	2,100
0.5-1	SCL	18.7	--	320	6	.32	430
1-1.5	SCL	14.0	--	340	0	.11	23
1.5-2	SCL	12.9	--	360	0	.02	7
2-3	SCL	13.2	1.5	--	0	.00	38
3-4	SCL	11.9	--	390	0	.03	19
4-5	SCL	13.0	--	380	1	.04	13
5-6	SCL	15.8	7.0	--	1	.01	2
6-7	SiCL	20.8	--	390	1	.03	5
7-8	SiCL	18.2	--	390	0	.01	12
8-9	SL	13.6	1.4	--	1	.03	3
9-10	S	8.9	--	420	0	.01	5

Contd.

Table 15.--Location 9: Chemical and physical analyses of cores and water samples taken near Peckham, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 9-G (contd.):							
10-11	GS	1.9	--	420	1	0.00	0
11-12	GS	3.1	--	410	0	.01	6
12-13	GS	6.1	--	390	0	.01	3
13-14	GS	10.4	--	400	0	.01	12
14-15	GS	10.5	--	300	2	.03	0
15-16	GS	13.9	--	360	1	.06	13
Water sample				--	24	.12	11
Core 9-H (corral):							
0-0.1	M	27.6	--	380	0	.87	2,300
0.1-0.3	SCL	14.4	--	340	0	.12	1,100
0.3-0.5	SCL	10.4	--	340	0	.09	740
0.5-1	SCL	10.1	--	350	0	.13	380
1-1.5	SCL	9.8	--	370	6	.21	110
1.5-2	SCL	11.7	--	370	19	.33	38
2-3	SCL	10.3	1.2	--	32	.26	3
3-4	SCL	11.1	--	320	39	.12	8
4-5	SCL	11.1	--	320	28	.10	3
5-6	SiCL	14.5	2.3	--	38	.32	13
6-7	L	16.9	--	380	38	.04	3
7-8	L	17.2	--	410	38	.01	0
8-9	SiCL	19.3	1.3	--	16	.01	0
9-10	SiCL	20.4	--	400	16	.02	8
10-11	SiL	21.8	--	400	12	.02	6
11-12	CL	19.7	--	340	3	.07	1
12-13	S	6.6	--	370	1	.04	0
13-14	S	2.1	3.2	--	0	.04	0
14-15	S	2.9	--	380	1	.03	7
15-16	S	7.7	--	380	3	.05	3
16-17	S	11.9	--	360	2	.02	10
17-18	GS	12.5	--	330	8	.04	0
18-19	S	13.4	--	420	9	.02	0
Water sample				-30	41	.07	2.9

Contd.

Table 15.--Location 9: Chemical and physical analyses of cores and water samples taken near Peckham, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 9-I (corral):							
0-0.1	M	28.9	--	380	0	--	2,300
0.1-0.3	SCL	15.8	--	340	0	0.09	1,500
0.3-0.5	SCL	15.1	--	340	7	.04	1,800
0.5-1	SCL	14.1	--	340	0	.04	500
1-1.5	SCL	14.3	--	340	9	.26	110
1.5-2	SCL	15.3	--	350	69	1.70	11
2-3	SCL	9.5	1.4	--	130	.66	4
3-4	SCL	11.2	--	350	160	.33	3
4-5	SL	9.8	--	380	170	.11	2
5-6	SL	13.1	.3	--	180	.12	3
6-7	SL	14.8	--	350	190	.14	2
7-8	SL	14.0	--	370	190	.14	0
8-9	SL	12.9	5.5	--	76	1.10	4
9-10	SiL	15.7	--	430	52	.39	2
10-11	SiCL	19.7	--	440	33	.03	0
11-12	SiCL	16.9	--	430	20	.06	3
12-13	CL	18.7	--	450	11	.13	9
13-14	S-C	13.1	--	--	5	.09	9
14-15	S-C	21.1	--	440	6	.10	12
15-16	S	12.2	--	340	3	.07	17
16-17	GS	5.9	--	400	-	.15	0
17-18	GS	7.0	--	400	7	.02	5
18-19	GS	16.0	--	380	5	.05	1
Core 9-J (irrigated field):							
0-0.5	SCL	10.1	--	470	11	.17	0
0.5-1	SCL	12.7	--	470	31	.08	3
1-1.5	SCL	13.2	--	480	42	.00	3
1.5-2	SCL	12.9	--	480	31	.01	1
2-3	SiCL	15.8	29	--	14	.08	1
3-4	SiCL	16.3	--	450	6	.02	1
4-5	SL	15.1	--	480	4	.00	2
5-6	SL	15.4	--	--	4	.04	2

Contd.

Table 15.--Location 9: Chemical and physical analyses of cores and water samples taken near Peckham, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 9-J (contd.):							
6-7	SL	15.4	--	470	2	0.03	2
7-8	S	21.3	--	420	0	.03	2
Water sample				430	8.5	.00	0
Core 9-K (nonirrigated cultivated field):							
0-0.5	SL	10.0	--	530	2	.02	1
0.5-1	SL	9.6	--	550	1	.02	0
1-1.5	SL	5.9	--	540	0	.07	2
1.5-2	--	--	--	--	--	--	--
2-3	SCL	4.0	--	480	0	.01	3
3-4	GS	4.7	--	450	0	.00	0
4-5	GS	5.0	--	490	0	.01	2
5-6	Sst	7.9	--	460	2	.01	1
6-7	Sst	9.1	--	520	3	.02	2
7-8	Sst	3.4	--	480	1	.01	0
8-9	Sst	6.3	--	490	1	.00	2
Core 9-L (nonirrigated cultivated field)							
0-1	SL	9.0	--	510	0	.02	2
1-2	SL	5.3	--	540	0	.00	1
2-3	SL	4.6	.3	--	--	.00	2
3-4	SL	6.3	--	480	0	.01	0
4-5	SCL	13.8	--	480	1	.01	1
5-6	SL	8.7	3.5	--	1	.01	1
6-7	SL	7.9	--	480	1	.01	2
7-8	SL	6.8	--	490	0	.00	2
8-9	SiL	9.4	--	490	0	.00	--
9-10	C-G	13.3	.8	--	1	.01	1
10-11	C	13.6	--	470	1	.01	2
11-12	C	13.5	--	480	1	.03	1
12-13	Sst	12.1	--	380	1	.01	2
13-14	Sst	12.1	--	400	--	.01	1

Location No. 10

General Location: Approximately 2 miles N. of Brighton, Colo.

General Remarks:

Soils:	Cores A, B, and D - Gilcrest gravelly sandy loam	Slope: 0-1 pct.
	Core C - Wet clayey soil	Slope: 0-1 pct.
	Cores E, F, and G. - Ascalon sandy loam	Slope: 1-3 pct.

Corrals: Cores from two groups of corrals were obtained (fig. 22). Cores 10-F and 10-G were taken from dairy lots, which were 6 and 40 years old, respectively. Approximately 100 dairy cows are kept in the corrals, and the manure is removed once a year. Cores 10-C and 10-D were taken from two of a large group of corrals where 5 to 6 thousand cattle are fed. The corrals are approximately 10 years old. The manure is removed once a year. The pen where core 10-D was taken generally contains about 300 cattle and the pen where 10-C was obtained generally has about 450 head. Cattle are in the corrals approximately 10 months each year.

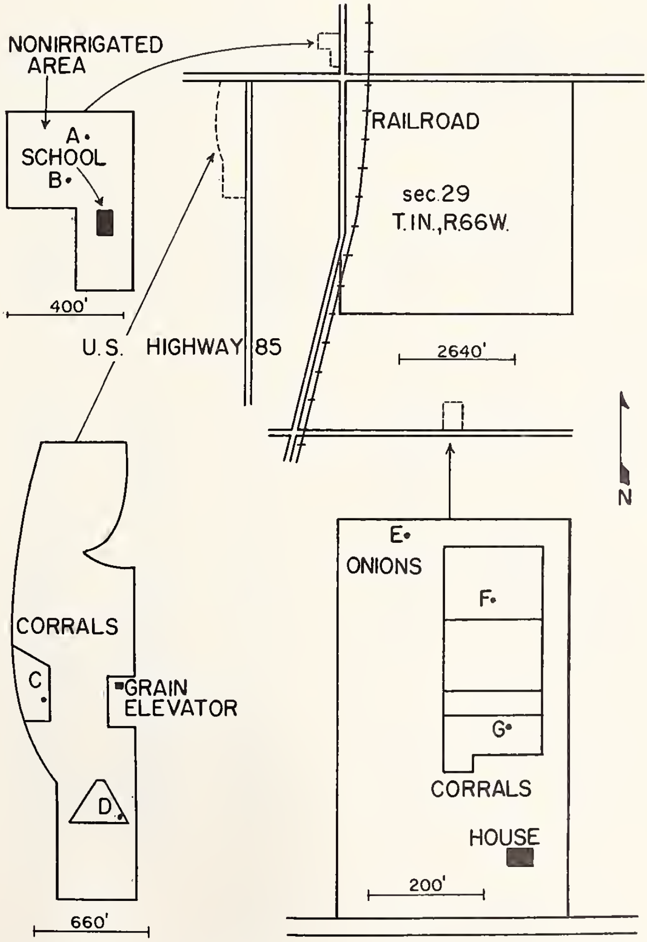


Figure 22.--Location 10 and core sites, near Brighton, Colo.

Significant findings:

Cores 10-A and 10-B were obtained from the school play area, which is fairly representative of the other areas at this location. These cores contained only small amounts of nitrate, nitrite, and ammonium (table 16). Contrasted with these, core 10-E from an irrigated cornfield had several parts per million of nitrate-N at nearly all depths, indicating that nitrate was moving through the soil and into the ground water.

The corral cores, representing two groups of corrals, presented quite different results. The dairy-corral cores, 10-F and 10-G, contained quite large amounts of nitrate at all depths. On the other hand, the cores from the feedlot (10-C and 10-D) were almost completely devoid of nitrate. These dissimilarities are probably caused by the differences in the aeration status, as shown by the Eh values. The dairy lot cores appeared to be fairly well aerated, but the Eh values of the first several feet of the other corral cores were below 320 mv., which is about the minimum value believed necessary for nitrate accumulation. The aeration differences are probably related to the manure management and stocking rates of the different corrals. There was a much higher concentration of ammonium in the water under poorly aerated cores.

Table 16.--Location 10: Chemical and physical analyses of cores and water samples taken near Brighton, Colo., 1966

Core, depth (ft.) and water sample	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 10-A (nonirrigated soil):							
0-0.5	SC	2.7	--	530	2	0.06	3
0.5-1	SC	5.5	--	530	2	.00	0
1-1.5	SC	5.8	--	560	0	.00	1
1.5-2	S	3.1	--	560	1	.00	4
2-3	GS	1.3	--	580	0	.01	1
3-4	GS	1.0	--	600	0	.00	2
4-5	GS	.6	--	590	1	.01	2
5-6	GS	.7	--	600	1	.00	1
6-7	GS	.8	--	610	1	.00	1
7-8	GS	1.0	--	570	1	.01	0
8-9	GS	.5	--	590	1	.02	1
9-10	GS	1.5	--	590	0	.01	2

Contd.

1/ See table 1 for texture symbols.

Table 16.--Location 10: Chemical and physical analyses of cores and water samples taken near Brighton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 10-A (Contd.)							
10-11	GS	2.1	--	530	0	0.00	1
11-12	GS	1.2	--	510	0	.02	0
12-13	GS	2.8	--	510	0	.01	1
13-14	GS	1.8	--	540	0	.01	1
14-15	GS	2.3	--	530	0	.01	1
15-16	GS	1.6	--	550	0	.01	1
16-17	--	--	--	--	--	--	--
17-18	G	2.3	--	530	0	.01	1
18-19	G	21.5	--	510	1	.02	1
19-20	G	8.9	--	490	1	.01	1
Water sample				450	18	.26	.6
Core 10-B (nonirrigated sod):							
0-0.5	SC	3.7	--	400	0	.02	1
0.5-1	SC	8.3	--	400	0	.00	2
1-1.5	SC	9.4	--	450	0	.01	0
1.5-2	S	3.9	--	460	0	.03	1
2-3	S	.6	--	--	0	--	--
3-4	GS	.9	--	480	1	.00	0
4-5	GS	1.2	--	530	0	.00	2
5-6	GS	3.2	--	540	2	.01	2
6-7	GS	1.2	--	540	1	.01	1
7-8	GS	1.2	--	520	--	.01	1
8-9	GS	1.0	--	550	0	.01	0
9-10	GS	1.8	--	530	1	.02	1
10-11	GS	1.4	--	510	0	.01	0
11-12	GS	1.3	--	530	1	.01	0
12-13	GS	1.2	--	490	1	.02	0
13-14	GS	1.0	--	540	1	.01	1
14-15	GS	--	--	--	--	--	--
15-16	GS	--	--	--	--	--	--
16-17	G	1.6	--	450	1	.00	2
17-18	G	1.7	--	460	0	.02	1

Contd.

Table 16.--Location 10: Chemical and physical analyses of cores and water samples taken near Brighton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3-N	NO_2-N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 10-B (Contd.)							
18-19	G	--	--	--	--	--	--
19-20	G	8.6	--	430	1	0.02	1
20-21	G	7.8	--	450	1	.01	0
Water sample				400	16	.07	0
Core 10-C (corral):							
0-0.2	M	23.6	--	280	0	.00	2,400
0.2-0.5	SL	7.4	--	260	0	.00	830
0.5-1	SCL	22.1	--	210	0	.00	670
1-1.5	SCL	18.8	--	250	0	.00	8
1.5-2	SCL	20.6	--	250	0	.00	220
2-3	SCL	24.3	39	--	0	.02	38
3-4	G-C	27.6	--	160	0	.00	180
4-5	G-C	20.3	--	160	0	.00	10
Water sample				190	0	.03	13
Core 10-D (corral):							
0-0.2	M	23.0	--	200	--	.00	4,900
0.2-0.5	SL	18.9	--	230	0	.00	2,500
0.5-1	SL	9.0	--	270	0	.07	300
1-1.5	SL	5.1	--	310	0	.02	14
1.5-2	GS	.1	--	440	0	.01	7
2-3	GS	.8	--	440	2	.00	2
3-4	GS	.2	--	450	0	.00	7
4-5	GS	.4	--	460	0	.01	12
5-6	GS	.9	--	480	1	.01	2
6-7	GS	1.0	--	470	0	.02	2
7-8	GS	1.0	--	410	0	.01	2
8-9	GS	1.2	--	500	0	.02	2
9-10	GS	5.4	--	460	0	.02	1
10-11	GS	9.0	--	200	0	.02	1
Water sample				340	5.3	.07	22

Contd.

Table 16.--Location 10: Chemical and physical analyses of cores and water samples taken near Brighton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 10-E (irrigated field)							
0-0.5	SCL	13.4	--	420	39	0.02	16
0.5-1	SL	15.1	--	460	19	.02	2
1-1.5	SL	12.3	--	470	18	.01	--
1.5-2	SL	10.4	--	470	12	.01	4
2-3	SL	7.0	29	--	9	.03	2
3-4	SL	8.9	--	440	8	.00	2
4-5	SL	9.4	--	390	11	.01	2
5-6	SL	10.6	31	--	11	.00	2
6-7	SL	11.2	--	420	9	.03	0
7-8	SL	10.7	--	440	3	.02	1
8-9	SL	14.9	23	--	7	.02	1
9-10	SL	8.4	--	420	7	.02	1
10-11	SCL	12.2	--	460	9	.03	1
11-12	SCL	12.9	--	380	8	.02	1
12-13	GS	14.5	--	420	6	.04	1
13-14	GS	1.5	--	390	0	.02	1
14-15	GS	1.5	--	400	2	.01	1
15-16	GS	5.3	--	420	0	.02	1
16-17	GS	9.9	--	370	1	.02	0
17-18	GS	15.1	--	380	2	.02	0
Core 10-F (corral):							
0-0.1	M	22.0	--	320	130	11	150
0.1-0.3	SL	8.5	--	390	48	.05	6
0.3-0.5	SL	8.2	--	430	50	.06	9
0.5-1	SL	7.4	--	440	36	.00	4
1-1.5	SL	7.1	--	450	33	.10	4
1.5-2	SL	7.0	--	430	31	.08	4
2-3	SCL	13.8	1.9	--	55	.09	3
3-4	SL	5.8	--	410	20	.06	4
4-5	SL	5.1	--	430	15	.02	1
5-6	SL	7.6	3.2	--	14	.03	2

Contd.

Table 16.--Location 10: Chemical and physical analyses of cores and water samples taken near Brighton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 10-F (Contd.):							
6-7	SL	6.0	--	420	11	0.02	1
7-8	SL	7.7	--	410	6	.02	1
8-9	SL	10.4	16	--	4	.02	4
9-10	SL	11.5	--	450	8	.17	1
10-11	SCL	12.7	--	470	2	.02	4
11-12	L	13.0	--	430	2	.02	4
12-13	GS	9.8	--	470	3	.02	1
13-14	SCL	19.9	--	460	2	.03	0
14-15	GS	12.0	--	460	1	.02	1
Water sample				490	14	.02	0
Core 10-G (corral):							
0-0.1	M	11.1	--	400	185	1.4	70
0.1-0.3	SCL	5.1	--	410	83	.04	--
0.3-0.5	SCL	7.8	--	420	86	.04	8
0.5-1	SCL	5.9	--	430	93	.04	0
1-1.5	CL	5.3	--	440	76	.03	3
1.5-2	CL	5.0	--	440	63	.03	1
2-3	SL	6.3	2.8	--	53	.09	1
3-4	SL	6.2	--	360	36	.07	3
4-5	L	12.1	--	410	54	.02	4
5-6	L	18.1	7.0	--	25	.02	2
6-7	SC	10.1	--	400	22	.01	1
7-8	SL	11.0	--	400	11	.04	4
8-9	GS	9.7	--	--	9	.04	2
9-10	GS	10.5	--	360	2	.02	4
10-11	GS	13.3	--	320	1	.03	2
11-12	GS	20.5	--	440	2	.01	7
Water sample				270	24	2.9	2.4

Location No. 11

General Location: West edge of Brighton, Colo.

General Remarks:

Soils: Cores A, B, and C - Nunn clay loam Slope: 0-1 pct.
Core D - Ascalon loam Slope: 0-3 pct.
Cores E and F - Dacono loam Slope: 0-1 pct.
Cores G, H, and I - Nunn loam Slope: 0-1 pct.
Core J - Fort Collins loam Slope: 0-1 pct.

Corrals: The corrals where cores G and H were taken are located on a low terrace near the river (fig. 23), and the water table is only about 5 feet below the surface. The larger corral generally contains about 75 dairy cows and is approximately 60 years old. The smaller corral is 90 years old but has been used only for shelter during winter storms for the last several years. Core I was taken from a 20-year-old corral that usually contains 150 cattle. The manure in these corrals is removed once a year.

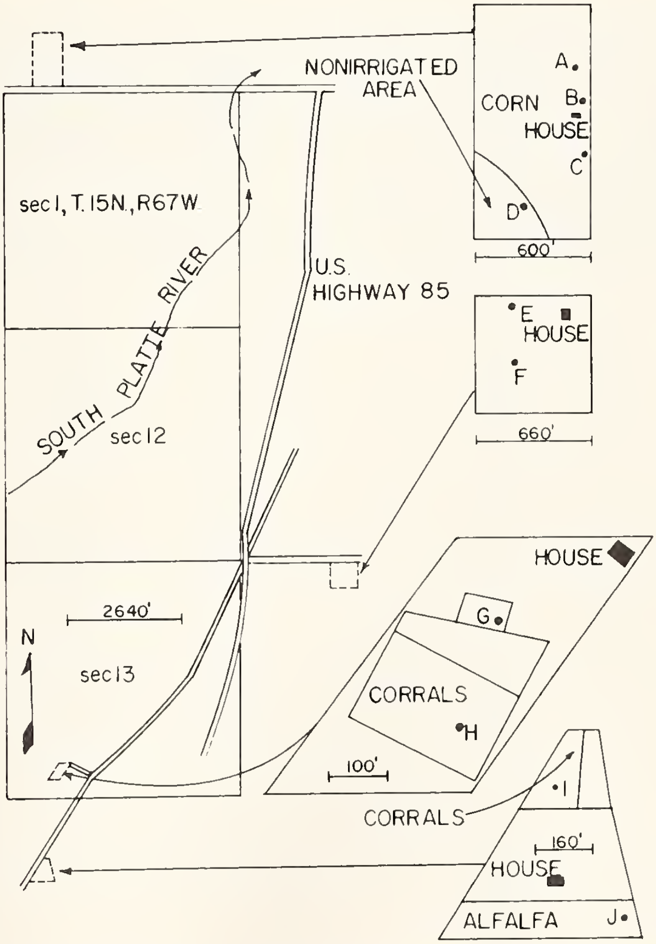


Figure 23.--Location 11 and core sites, near Brighton, Colo.

Irrigated Fields: The fields where cores A, B, C, E, and F were taken are generally planted to corn, sugar beets, or onions. Alfalfa had not been grown for 6 years on the field where cores E and F were obtained, or for 20 years where cores A, B, and C were taken. Core J was taken from a field that had been in continuous alfalfa for 5 years.

Nonirrigated Area: The site is located on a sloping area where irrigation water could not be diverted. The site has not been cropped.

Fertilizer Practices: No manure has been used for at least 8 years. Commercial fertilizers are used yearly to supply 120 pounds of N and 200 pounds of P_2O_5 per acre to the crops.

Water Quality: Considerable trouble has been experienced with water where cores G and H were taken. Water samples analyzed since 1960 ranged in nitrate-N from 2 to 20 p.p.m. Calves have been severely affected, according to the farm operator, who is a veterinarian. The dairy cows do not seem to be badly affected, although milk production is not high.

Significant findings:

Cores G, H, and I were taken from corrals and substantial amounts of nitrate were found at all depths (table 17). Core G contained less nitrate than cores H and I, but this core was taken from a corral that had been little used for several years. There were also significant concentrations of nitrite and ammonium present in the cores obtained from corrals. The cores from irrigated fields, with exception of core J that came from an alfalfa field, contained nitrate in excess of 1 p.p.m. at most depths. Core D came from a nonirrigated area and contained only small amounts of nitrate.

Table 17.--Location 11: Chemical and physical analyses of cores and water samples taken near Brighton, Colo., 1966

Core, depth (ft.) and water sample	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 11-A (irrigated field):							
0-0.5	SCL	18.2	--	430	230	0.06	4
0.5-1	SCL	19.8	--	440	88	.04	4
1-1.5	SCL	18.8	--	460	4	.02	2
1.5-2	SCL	19.4	--	460	2	.02	0
2-3	CL	22.0	--	--	3	--	--
3-4	CL	28.5	--	470	10	.12	1
4-5	CL	27.2	--	430	15	.04	5
5-6	GS	3.8	1.5	--	1	.02	2
6-7	GS	10.5	--	470	1	.01	2
7-8	GS	10.8	--	420	0	.02	1
8-9	GS	13.0	--	420	3	.03	2
9-10	GS	9.3	--	360	0	.02	1
Water sample				150	7.2	1.3	.1
Core 11-B (irrigated field):							
0-0.5	SCL	14.8	--	460	34	.03	4
0.5-1	SCL	19.8	--	480	24	.02	0
1-1.5	SCL	20.9	--	480	26	.01	0
1.5-2	SCL	18.9	--	480	41	--	--
2-3	SCL	27.0	1.0	--	13	.02	1
3-4	SCL	25.8	--	480	4	.02	2
4-5	CL-GS	16.0	--	500	1	--	--
5-6	GS	.6	--	--	0	--	--
6-7	GS	6.1	--	460	0	.00	2
7-8	GS	9.3	--	440	0	.02	1
8-9	GS	10.7	--	420	0	.02	--
9-10	GS	9.8	--	380	0	.02	2
10-11	--	--	--	--	--	--	--
11-12	C	21.3	--	450	2	.02	6
Water sample				350	1.4	.66	0

Contd.

1/ See table 1 for texture symbols.

Table 17.--Location 11: Chemical and physical analyses of cores and water samples taken near Brighton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^--N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 11-C (irrigated field)							
0-0.5	SCL	14.0	--	490	31	0.02	3
0.5-1	SCL	18.3	--	480	11	.02	1
1-1.5	SCL	19.1	--	490	12	.02	4
1.5-2	L	22.7	--	490	18	.02	2
2-3	SL	7.8	2.7	--	7	.00	0
3-4	SL	7.9	--	450	13	.01	1
4-5	GS	.9	--	420	1	.00	2
5-6	GS	1.0	--	430	1	.00	2
6-7	GS	1.3	--	420	2	.02	1
7-8	GS	7.0	--	400	1	.03	1
8-9	GS	10.7	--	430	1	.07	2
9-10	GS	11.0	--	430	0	.01	1
Water sample				420	8.8	1.1	.2
Core 11-D (nonirrigated cultivated field):							
0-0.5	L	5.2	--	530	--	.03	2
0.5-1	L	7.5	--	550	--	.01	3
1-1.5	L	6.1	--	560	0	.02	0
1.5-2	L	5.0	--	560	0	.04	0
2-3	L	6.5	.5	--	0	.05	2
3-4	SL	6.8	--	570	0	.01	2
4-5	SL	8.7	--	570	0	.01	3
5-6	SL	10.8	1.3	--	1	.00	2
6-7	SL	9.3	--	560	0	.02	0
7-8	SCL	12.2	--	560	1	.03	1
8-9	SCL	12.4	.3	--	0	.03	1
9-10	SCL	11.0	--	440	1	.02	1
10-11	SCL	13.8	--	410	0	.04	0
11-12	SCL	15.3	--	390	0	.02	2
12-13	SCL	16.0	--	410	0	.03	1
13-14	SL	16.2	11	--	0	.04	2
14-15	SL	16.4	--	400	0	.02	1
15-16	S	21.2	--	430	1	.02	2
16-17	C	26.6	--	450	2	.03	2
Water sample				410	7.9	.03	0

Contd.

Table 17.--Location 11: Chemical and physical analyses of cores and water samples taken near Brighton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 11-E (irrigated field):							
0-0.5	CL	13.6	--	590	24	0.03	3
0.5-1	CL	14.1	--	590	12	.03	2
1-1.5	SCL	12.0	--	570	4	.01	2
1.5-2	SCL	13.5	--	580	1	.01	2
2-3	SCL	4.0	23	--	1	.00	3
3-4	GS	5.7	--	570	0	.00	4
4-5	GS	1.5	--	570	0	.00	1
5-6	GS	1.5	--	510	1	.00	1
6-7	GS	1.5	--	490	0	.02	0
7-8	GS	1.2	--	490	0	.02	1
8-9	GS	1.9	--	470	0	.02	1
9-10	GS	2.5	--	500	1	.02	1
10-11	GS	5.0	--	--	1	.02	1
11-12	GS	4.6	--	460	0	.02	1
12-13	GS	3.0	--	490	2	.02	0
13-14	GS	1.7	--	460	0	.04	0
14-15	GS	1.9	--	480	1	.03	1
15-16	GS	1.7	--	490	0	.02	1
16-17	GS	1.7	--	450	0	.02	1
17-18	GS	2.5	--	460	0	.01	1
18-19	GS	2.6	--	470	1	.01	0
19-20	GS	2.6	--	370	0	.02	1
20-21	GS	3.0	--	590	0	.02	1
21-22	GS	2.7	--	570	0	.03	3
22-23	GS	3.5	--	610	0	.02	0
23-24	GS	6.6	--	370	0	.02	1
Water sample				520	18	.15	.1

Contd.

Table 17.--Location 11: Chemical and physical analyses of cores and water samples taken near Brighton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 11-F (irrigated field):							
0-0.5	SCL	11.8	--	600	31	0.02	3
0.5-1	SCL	11.5	--	580	18	.02	1
1-1.5	SCL	15.0	--	580	7	.01	2
1.5-2	SCL	15.4	--	570	5	.01	2
2-3	GS	18.8	--	--	3	.00	1
3-4	GS	1.5	--	570	1	.02	3
4-5	GS	1.6	--	550	0	.01	1
5-6	GS	1.6	--	590	1	.00	1
6-7	GS	1.6	--	570	0	.01	3
7-8	GS	1.4	--	540	0	.01	1
8-9	GS	1.4	--	460	1	.01	1
9-10	GS	1.5	--	500	1	.00	1
10-11	GS	1.9	--	510	1	.01	1
11-12	GS	2.0	--	510	1	.01	2
12-13	GS	2.0	--	510	1	.01	2
13-14	GS	1.3	--	460	1	.00	0
14-15	GS	2.2	--	500	1	.01	2
15-16	GS	1.3	--	530	1	.02	1
16-17	GS	1.7	--	560	0	.02	1
17-18	GS	3.1	--	550	2	.00	1
18-19	GS	2.9	--	540	1	.00	0
19-20	GS	2.6	--	510	1	.02	1
20-21	GS	3.1	--	500	3	.01	1
21-22	GS	2.1	--	510	1	.01	0
22-23	GS	2.3	--	510	1	.02	0
23-24	GS	7.4	--	500	2	.02	1
Water sample				430	15	.15	0

Contd.

Table 17.--Location 11: Chemical and physical analyses of cores and water samples taken near Brighton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3-N	NO_2-N	NH_4-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 11-G (corral):							
0-0.3	M	43.6	--	420	37	1.4	65
0.3-0.6	CL	26.4	--	380	6	.35	10
0.6-1	CL	22.8	--	400	0	.06	1
1-1.5	CL	25.4	--	420	8	.05	2
1.5-2	CL	25.9	--	420	6	.13	4
2-3	CL	31.3	--	--	0	.17	5
3-4	CL	26.9	--	430	0	.07	2
4-5	CL	26.3	--	460	2	.03	2
5-6	CL	33.1	--	450	0	.19	2
6-7	GS	30.9	--	490	3	.01	2
Water sample				460	11	.51	0
Core 11-H (corral):							
0-0.2	M	56.6	--	300	11	.12	1,100
0.2-0.5	CL	16.7	--	350	6	.15	65
0.5-1	CL	22.0	--	370	42	.25	3
1-1.5	CL	26.7	--	380	28	.57	3
1.5-2	CL	30.3	--	400	11	.42	6
2-3	CL	25.4	0.5	--	3	.03	2
3-4	S	24.4	--	430	2	.01	2
4-5	SL	34.2	--	440	3	.07	0
5-6	SCL	28.8	--	460	3	.01	2
Water sample				420	8.1	.89	.5

Contd.

Table 17.--Location 11: Chemical and physical analyses of cores and water samples taken near Brighton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 11-I (corral):							
0-0.2	M	22.7	--	260	63	2.3	47
0.2-0.5	SL	16.8	--	340	120	.27	0
0.5-1	SL	14.3	--	460	59	.17	1
1-1.5	SL	13.5	--	450	49	.03	1
1.5-2	SL	12.4	--	460	33	.19	4
2-3	SL	9.8	1.5	--	19	.06	2
3-4	SL	15.1	--	450	24	.12	2
4-5	SiL	21.9	--	440	36	.03	0
5-6	SiL	16.9	2.0	--	20	.03	1
6-7	S	16.4	--	440	21	.00	0
7-8	S	16.1	--	440	23	.02	1
8-9	CL	13.6	6.3	--	23	.04	2
9-10	CL	16.1	--	460	35	.03	1
10-11	GS	5.2	--	470	21	.01	0
11-12	GS	1.7	--	450	7	.02	0
12-13	GS	1.2	--	450	3	.01	1
13-14	GS	1.5	--	430	5	.00	1
14-15	GS	5.9	--	450	11	.01	1
15-16	GS	1.6	--	250	3	.01	1
16-17	GS	1.5	--	340	3	.01	1
17-18	GS	1.4	--	400	3	.01	1
18-19	GS	1.3	--	420	1	.00	2
19-20	GS	1.1	--	420	1	.01	1
20-21	GS	1.1	--	350	0	.01	1
21-22	GS	1.4	--	400	0	.00	0
22-23	GS	2.3	--	400	0	.00	0
Water sample				430	9.0	.35	.3

Contd.

Table 17.--Location 11: Chemical and physical analyses of cores and water samples taken near Brighton, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 11-J (irrigated alfalfa):							
0-0.5	SCL	7.4	--	600	3	0.07	4
0.5-1	SCL	10.4	--	520	1	.03	0
1-1.5	SCL	15.8	--	520	1	.04	2
1.5-2	SCL	10.3	--	510	1	.00	0
2-3	SCL	9.6	--	--	1	.02	2
3-4	S	10.0	--	440	0	.00	3
4-5	SiL	22.0	--	470	0	.00	6
5-6	SiCL	15.4	--	--	0	.01	3
6-7	SL	18.9	--	450	0	.01	1
7-8	SiL	30.0	--	460	0	.01	2
8-9	SL	21.9	.4	--	0	.01	1
9-10	SL	21.4	--	430	1	.01	1
10-11	CL	23.8	--	490	1	.01	2
11-12	CL-G	15.1	--	480	1	.01	2
12-13	CL-G	15.8	--	490	1	.01	--
13-14	CL-S	14.6	--	460	0	.01	3
14-15	GS	1.0	--	420	0	.01	0
15-16	GS	1.8	--	430	0	.00	1
16-17	GS	2.0	--	430	0	.01	1
17-18	GS	1.8	--	420	0	.00	0
18-19	GS	1.8	--	420	0	.00	2
19-20	GS	2.1	--	490	0	.01	2
20-21	GS	2.2	--	500	0	.01	1
21-22	GS	2.4	--	500	0	.00	1
22-23	GS	2.2	--	470	0	.00	0
Water sample				530	7.9	.09	.1

Location No. 12

General Location: 1-$^{1}/_{2}$ miles W. of Prospect, Colo.

General Remarks:

Soils:	Cores A, B, and C - Colby loam	Slope: 0-1 pct.
	Cores D and E - Colby loam	Slope: 1-3 pct.
	Core G - Ascalon sandy loam	Slope: 1-3 pct.
	Core H - Weld loam	Slope: 1-3 pct.

Corrals: The corrals range in age from 3 to 15 years. Cores A and B were obtained from 3- and 15-year-old corrals, respectively (fig. 24). The approximate stocking rate is 225 cattle in each corral. The manure is removed at least three times a year.

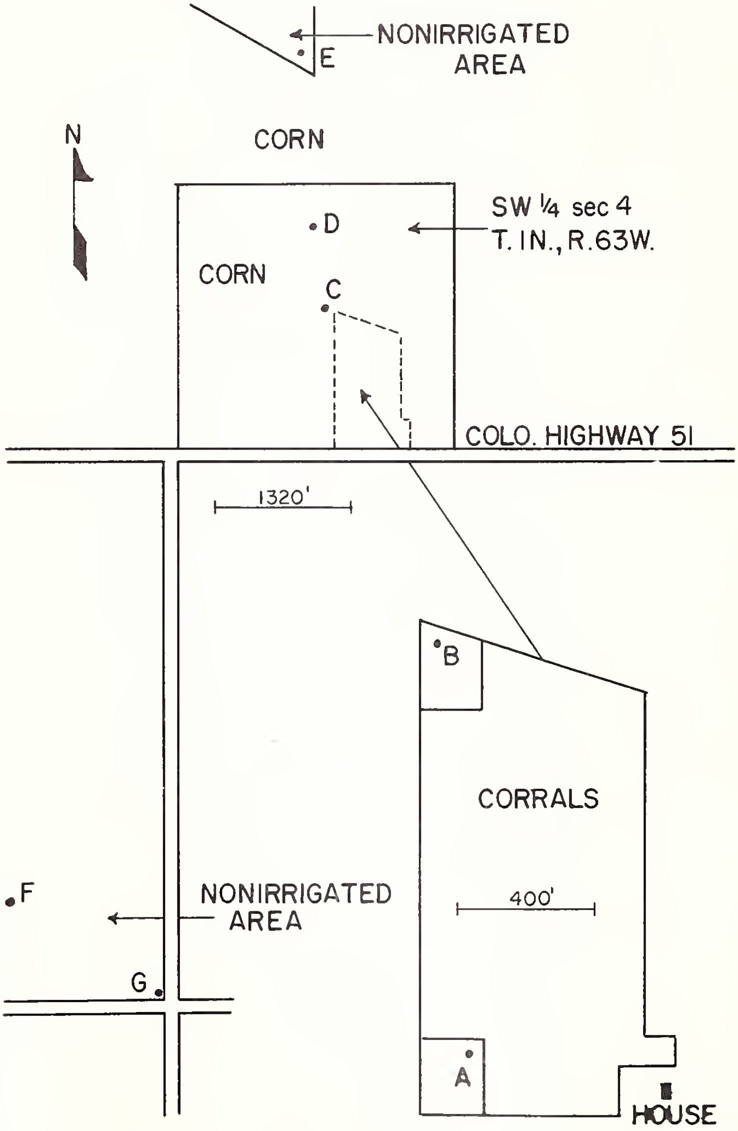


Figure 24.--Location 12 and core sites, near Prospect, Colo.

Irrigated Fields: Sugar beets and corn are grown in alternate years. Core D was taken from an area that was in alfalfa in 1962. Core C was taken from a field that had not been planted in alfalfa for 15 years before sampling.

Nonirrigated Fields: The areas are alternated with wheat and fallow. The site where core F was taken was irrigated for several years before 1940 with ditch water. Irrigations were infrequent because of the water shortage.

Fertilizer Practices: Manure is added to the irrigated fields each year at the rate of 20 tons per acre. In addition, commercial fertilizers are added to supply 100 pounds of N and 50 pounds of P_2O_5 per acre to the fields planted to corn, and 80 pounds of N and 50 pounds of P_2O_5 to fields planted to sugar beets.

The nonirrigated areas have not received fertilizer, with the possible exception of the area where core F was obtained (fig. 24). The farmer stated that although he did not believe the area had been fertilized, it is possible that it received some fertilizer when it was irrigated.

Water Quality: The farmer has not experienced any difficulties with the quality of the well water. The water table has fluctuated about 15 feet since about 1955.

Significant findings:

There were substantial levels of nitrate in the corral profiles, but the concentrations decreased rapidly with depth and very little nitrate was present below 20 feet. The top parts of the cores from the irrigated fields contained smaller concentrations of nitrate than the lower parts. The first foot of core C was very high in nitrates (table 18). The cause of this finding is unknown, but is probably the result of sampling in a site where manure or commercial fertilizer was concentrated. The dryland cores contained small amounts of nitrates, and in general nitrate levels increased below the normal rooting depth of about 6 feet. Core G contained very large amounts of nitrate in the top 2 feet. As no fertilizer had been applied to this area, the origin of this nitrate is unknown. Possibly, some wheat grain was spilled there during combining or seeding.

Table 18.--Location 12: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966

Core, depth (ft.) and water sample	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 12-A (corral):							
0-0.1	M	1.6	--	280	22	--	--
0.2-0.5	CL	10.3	--	350	210	0.45	840
0.5-1	CL	12.1	--	430	190	--	--
1-1.5	CL	14.7	--	430	88	.13	4
1.5-2	CL	16.1	--	430	44	.37	6
2-3	SiCL	9.7	2.2	--	8	.00	0
3-4	SiCL	13.8	--	440	10	--	--
4-5	SiCL	15.8	--	440	10	.00	3
5-6	SiCL	16.1	3.8	--	9	.00	4
6-7	SiCL	17.2	--	410	10	.01	2
7-8	SiCL	17.1	--	390	10	.02	2
8-9	SiCL	14.1	--	--	11	.01	3
9-10	SCL	10.0	--	420	9	.02	2
10-11	SCL	11.9	--	430	13	.01	--
11-12	SCL	12.5	--	400	13	.00	1
12-13	SCL	17.3	--	420	16	.00	3
13-14	CL	24.1	1.9	--	13	.01	2
14-15	SCL	13.0	--	440	3	.00	3
15-16	CL	23.7	--	460	7	.00	0
16-17	SL	8.4	--	420	3	.00	1
17-18	SL	9.3	--	430	2	.01	1
18-19	CL	17.6	1.2	--	1	.01	1
19-20	SCL	17.9	--	410	3	--	3
20-21	SCL	16.2	--	360	0	.05	2
21-22	SCL	16.3	--	410	1	.03	2
22-23	SCL	14.9	--	440	0	.04	1
23-24	SCL	12.6	1.0	--	1	.02	2
24-25	SCL	11.7	--	470	--	.04	1
25-26	CL	15.5	--	480	0	.03	1

Contd.

1/ See table 1 for texture symbols.

Table 18.--Location 12: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966--Continued

Cores, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 12-A (contd.):							
26-27	CL	18.1	--	470	1	0.02	1
27-28	CL	13.5	--	490	0	.05	1
28-29	CL	14.2	.4	--	0	.03	2
29-30	CL	13.6	--	460	0	.05	1
30-31	SL	11.3	--	470	0	.02	1
31-32	S	9.1	--	430	0	.00	1
32-33	S	3.4	--	410	0	.01	1
33-34	S	3.6	--	400	0	.01	2
34-35	S	3.1	--	420	0	.01	1
35-36	S	4.5	--	410	0	.01	2
36-37	S	13.3	--	400	1	.02	6
37-38	S	3.9	--	420	0	.01	1
38-39	S	9.4	--	420	0	.00	2
39-40	C	14.7	--	430	0	.02	1
40-41	GS	2.5	--	420	0	.01	1
41-42	GS	2.2	--	410	0	.01	1
42-43	GS	4.1	--	420	0	.03	14
43-44	L	8.2	--	430	1	.03	2
44-45	GS	10.2	--	310	1	.03	1
45-46	GS	3.3	--	340	0	.02	1
46-47	GS	9.2	--	370	1	.00	1
47-48	GS	18.5	--	370	2	.00	2
48-49	GS	15.6	--	380	1	.02	2
49-50	GS	16.2	--	310	--	.03	2
50-51	GS	12.3	--	340	2	.01	2
51-52	C	18.2	--	300	0	.02	2
Water sample				80	16	.30	--

Contd.

Table 18.--Location 12: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 12-B (corral):							
0-0.1	M	1.4	--	310	55	2.4	910
0.1-0.3	CL	9.7	--	350	200	.31	350
0.3-0.5	CL	10.3	--	380	98	.32	15
0.5-1	CL	16.6	--	370	59	.11	5
1-1.5	CL	--	--	400	25	.13	2
1.5-2	SiCL	15.7	--	410	15	.07	1
2-3	SiCL	13.8	1.3	--	6	.02	1
3-4	SiCL	15.7	--	370	6	.03	5
4-5	SiCL	17.7	--	400	5	.05	2
5-6	SiCL	18.1	1.4	--	2	.01	3
6-7	SiCL	18.1	--	370	1	.06	0
7-8	SiCL	16.6	--	410	0	.01	0
8-9	SiCL	10.1	5.0	--	0	.03	2
9-10	SCL	11.0	--	390	0	.03	0
10-11	SCL	10.8	--	420	0	.04	0
11-12	SCL	11.4	--	440	1	.02	5
12-13	SCL	14.9	--	390	0	.02	0
13-14	SCL	4.9	1.1	--	0	.02	--
14-15	SL	6.2	--	470	0	.03	2
15-16	SCL	11.6	--	480	0	.04	5
16-17	SCL	11.5	--	390	3	.06	3
17-18	SL	7.9	--	400	0	.05	2
18-19	SL	7.3	.6	--	0	.01	0
19-20	SL	12.9	--	420	1	.16	2
20-21	C	16.8	--	420	0	.04	0
21-22	SC	11.9	--	390	0	.06	0
22-23	SC	12.8	--	430	0	.03	2
23-24	SiCL	14.5	.3	--	0	.02	5
24-25	SiCL	12.3	--	370	0	.12	1
25-26	S	5.5	--	400	0	.02	0

Contd.

Table 18.--Location 18: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966-Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 12-B (Contd.):							
26-27	S	5.3	--	370	0	0.02	0
27-28	S	9.4	--	400	0	.02	0
28-29	S	6.4	1.2	--	0	.02	0
29-30	L	10.1	--	370	0	.01	1
30-31	SL	8.3	--	410	0	.03	2
31-32	S	4.7	--	320	0	.04	2
32-33	S	3.8	--	350	0	.04	--
33-34	S	6.2	--	380	0	.02	1
34-35	S	3.6	--	400	1	.05	3
35-36	S	2.6	--	400	0	.03	1
36-37	S	5.1	--	440	1	.02	0
37-38	SL	9.2	--	410	0	.01	0
38-39	GS	2.5	--	390	0	.03	2
39-40	S	2.3	--	380	0	.01	1
40-41	S	2.2	--	370	0	--	--
41-42	S	2.9	--	360	0	.02	2
42-43	GS	2.8	--	380	--	.02	2
43-44	GS	11.4	--	340	0	.04	2
44-45	GS	10.2	--	360	0	.03	1
45-46	GS	11.6	--	340	0	.01	2
46-47	GS	10.8	--	370	0	.01	0
47-48	SC	13.7	--	260	0	.01	0
Water sample				50	0	1.3	--
Core 12-C (irrigated field):							
0-0.5	CL	15.9	--	320	490	.06	9
0.5-1	CL	18.3	--	350	140	.26	2
1-1.5	CL	22.0	--	390	15	.01	3
1.5-2	CL	20.3	--	410	14	.01	2
2-3	CL	14.7	1.0	--	7	.00	2
3-4	CL	14.7	--	320	1	.01	0
4-5	SiCL	16.6	--	390	0	.00	2
5-6	SiCL	17.8	--	410	1	.00	2

Contd.

Table 18.--Location 12: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 12-C (Contd.)							
6-7	SiCL	17.0	--	340	2	0.01	2
7-8	SiCL	15.5	--	380	0	.02	2
8-9	SL	14.9	--	410	1	.02	2
9-10	SCL	15.1	--	350	0	.04	2
10-11	SCL	14.0	--	400	0	.02	2
11-12	SCL	13.1	--	420	0	.03	1
12-13	SCL	11.7	--	350	0	--	0
13-14	SCL	14.4	--	390	0	.00	2
14-15	C	21.7	--	430	0	.03	0
15-16	SL	12.2	--	400	0	.02	0
16-17	SL	11.4	--	410	0	.03	2
17-18	SiCL	17.6	--	350	2	.02	2
18-19	SL	12.4	--	350	8	.05	1
19-20	SL	9.5	--	390	1	.03	0
20-21	SL	9.5	--	370	1	.00	0
21-22	C	17.9	--	390	6	.02	3
22-23	SiCL	16.6	--	450	3	--	0
23-24	SiCL	15.3	--	530	1	.00	3
24-25	SCL	13.4	2.1	--	1	.03	2
25-26	SCL	14.7	--	400	10	.05	0
26-27	SCL	15.4	--	450	2	.00	0
27-28	SCL	13.4	--	460	2	.00	2
28-29	SL	13.8	--	450	4	.02	3
29-30	SL	12.6	15	--	4	.14	1
30-31	S	9.1	--	420	4	.06	0
31-32	S	4.0	--	280	2	.28	3
32-33	S	3.3	--	430	1	.43	0
33-34	S	3.7	--	390	1	.39	--
34-35	S	3.3	--	380	1	.38	2
35-36	GS	2.9	--	410	0	.41	0
36-37	GS	3.3	--	380	0	.38	2
37-38	GS	2.7	--	420	0	.42	0

Contd.

Table 18.--Location 12: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 12-C (Contd.)							
38-39	--	--	--	--	--	--	--
39-40	S	2.0	--	370	0	0.37	4
40-41	S	7.5	--	410	1	.41	0
41-42	S	2.7	--	400	0	.40	3
42-43	S	5.0	--	400	1	.40	2
43-44	S	14.9	--	390	1	.39	0
Water sample				150	0	.15	0
Core 12-D (irrigated field):							
0-0.5	SiL	15.7	--	440	17	.02	3
0.5-1	SiL	33.8	--	450	4	.01	3
1-1.5	SiL	16.9	--	460	1	.01	0
1.5-2	SiL	15.8	--	460	2	.00	2
2-3	SiL	17.5	10	--	2	.00	0
3-4	SiL	19.4	--	430	4	.00	0
4-5	SiL	15.2	--	450	1	.00	2
5-6	SiL	18.3	15	--	3	.02	2
6-7	SiL	18.9	--	450	5	.01	3
7-8	SiL	16.7	--	460	5	.00	0
8-9	SiL	19.4	40	--	7	.01	1
9-10	SiL	18.4	--	430	9	.01	1
10-11	SL	13.9	--	470	9	.00	1
11-12	SL	15.1	--	440	8	.01	1
12-13	SL	16.0	--	470	4	.01	1
13-14	SiCL	16.8	31	--	4	.00	0
14-15	SiCL	17.4	--	460	4	.01	1
15-16	SiCL	17.7	--	480	3	.01	1
16-17	SiCL	15.9	--	460	2	.01	1
17-18	SCL	13.7	--	480	1	.01	1

Contd.

Table 18.--Location 12: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 12-D (Contd.):							
18-19	SL	9.0	7.7	--	1	0.01	1
19-20	SL	10.2	--	460	1	.00	0
20-21	SL	11.1	--	470	2	.01	1
21-22	SL	12.5	--	440	2	.01	1
22-23	S	9.3	--	480	2	.01	1
23-24	SL	12.0	80	--	3	.02	1
24-25	SL	12.4	--	440	2	.01	0
25-26	SCL	15.0	--	490	1	.02	0
26-27	SL	10.8	--	490	4	.00	0
27-28	SL	10.8	--	440	3	.01	0
28-29	SCL	12.8	--	470	2	.01	0
29-30	SCL	10.5	9	--	1	.02	1
30-31	SCL	13.1	--	470	1	.01	0
31-32	SCL	14.8	--	440	1	.01	1
32-33	CL	16.8	--	470	2	.00	0
33-34	CL	18.3	14	--	2	.01	1
34-35	CL	18.1	--	490	1	.01	0
35-36	CL	16.8	--	470	1	.01	0
36-37	CL	17.7	--	480	1	.00	1
37-38	CL	19.5	--	500	1	.01	1
38-39	CL	21.3	10	--	1	.01	1
39-40	C	21.9	--	510	1	.01	1
40-41	CL	19.5	--	500	1	.03	0
41-42	SCL	19.5	--	480	2	.00	1
42-43	S	3.9	--	450	1	.01	1
43-44	S	3.1	--	460	1	.01	1
44-45	S	4.5	--	430	0	.00	0
45-46	S	3.4	--	430	0	.00	0
46-47	S	4.0	--	430	0	.01	1
47-48	S	7.2	--	440	1	.01	1
48-49	S	17.9	--	400	2	.01	1
49-50	C	25.3	--	440	2	.02	0
50-51	C	22.9	--	360	2	.00	1
Water sample				-330	10	.32	--

Contd.

Table 18.--Location 12: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 12-E (nonirrigated cultivated field):							
0-0.5	SiL	12.7	--	450	2	.01	1
0.5-1	SiL	15.1	--	450	2	.01	1
1-1.5	SiL	15.1	--	450	0	.00	3
1.5-2	SiL	12.7	--	450	0	--	--
2-3	SiL	9.4	1.5	--	0	.00	4
3-4	SiL	7.9	--	450	0	.00	1
4-4	SiL	7.8	--	480	0	.00	3
5-6	SiL	5.4	1.5	--	0	.00	0
6-7	SL	6.1	--	420	0	.01	2
7-8	SiL	10.6	--	450	0	--	--
8-9	SL	12.0	1.6	--	0	.02	--
9-10	SL	10.2	--	440	0	.01	3
10-11	SL	8.8	--	450	1	.00	1
11-12	SL	9.4	--	430	1	.00	1
12-13	SL	8.2	--	450	2	--	1
13-14	SL	6.4	1.0	--	2	.00	2
14-15	SL	5.9	--	430	2	.01	1
15-16	S	5.0	--	460	2	.01	1
16-17	S	3.6	--	410	2	.01	1
17-18	S	3.5	--	440	2	.02	1
18-19	S	3.3	2.1	--	3	.02	1
19-20	Sst	3.0	--	340	3	.01	2
Core 12-F (nonirrigated cultivated field):							
0-0.5	SCL	17.2	--	400	9	.01	2
0.5-1	SCL	14.8	2.3	400	6	.00	2
1-1.5	SCL	14.2	--	430	3	.00	5
1.5-2	SCL	13.4	--	450	1	.01	3
2-3	SCL	11.0	--	--	2	.00	2
3-4	SiL	11.4	--	430	3	.02	2
4-5	SiL	9.8	--	430	0	.00	3
5-6	SiL	6.8	5.0	--	1	.01	0

Contd.

Table 18.--Location 12: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 12-F (Contd.):							
6-7	SL	6.1	--	440	1	0.00	--
7-8	SL	5.6	--	420	1	.02	--
8-9	SL	5.0	.9	--	2	--	2
9-10	SL	4.6	--	430	2	.01	0
10-11	SL	13.1	--	410	4	.02	0
11-12	SL	3.6	--	420	3	.02	0
12-13	SL	2.5	--	400	2	.00	1
13-14	SL	2.0	.8	--	2	.04	2
14-15	GS	3.7	--	400	2	.01	1
15-16	GS-C	7.7	--	400	4	.02	0
16-17	GS-C	4.9	--	350	3	.02	1
17-18	G	3.7	--	340	3	.02	1
18-19	SC	14.4	--	330	5	.03	0
19-20	S	4.9	--	400	0	.00	2
Core 12-G (nonirrigated cultivated fields							
0-0.5	SCL	7.7	--	490	23	.20	5
0.5-1	SCL	11.5	--	510	96	.02	2
1-1.5	SCL	16.3	--	520	240	.03	0
1.5-2	SL	10.8	--	510	160	--	0
2-3	SL	4.1	1.3	--	3	.02	3
3-4	SL	3.9	--	370	2	.01	2
4-5	SiL	6.8	--	410	2	.00	1
5-6	SiL	6.5	4.5	--	0	.01	1

Contd.

Table 18.--Location 12: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 12-G (Contd.):							
6-7	SiL	7.8	--	350	0	.00	0
7-8	SiL	8.3	--	390	0	.00	2
8-9	SiL	8.1	2.9	--	1	.04	2
9-10	SL	7.0	--	330	1	.00	0
10-11	SL	3.8	--	380	1	.02	1
11-12	SL	3.6	--	340	1	.01	1
12-13	SL	4.0	--	390	2	.02	1
13-14	SiL	7.4	1.9	--	--	.01	1
14-15	SiL	7.2	--	330	3	--	1
15-16	SL	6.7	--	390	3	.00	0
16-17	SiCL	8.7	--	360	3	--	1
17-18	SiCL	9.5	--	400	2	.01	2
18-19	SiCL	7.1	1.2	--	2	.02	2
19-20	SiCL	9.7	--	390	1	.01	1
20-21	SiL	6.0	--	450	1	.01	0
21-22	SiL	7.3	--	460	2	--	--

Location No. 13

General Location: 1 mile E. and 2 miles N. of Prospect, Colo.

General Remarks:

Soils: Colby loam Slope: 0-1 pct.

Corrals: The corrals are 25 years old and are generally stocked with 175 cattle in each corral. From 1940 to 1955, the corrals were used from 4 to 6 months during the year, but they have been used almost continuously since 1955. Corrals are always cleaned each fall, and are sometimes cleaned again in the spring.

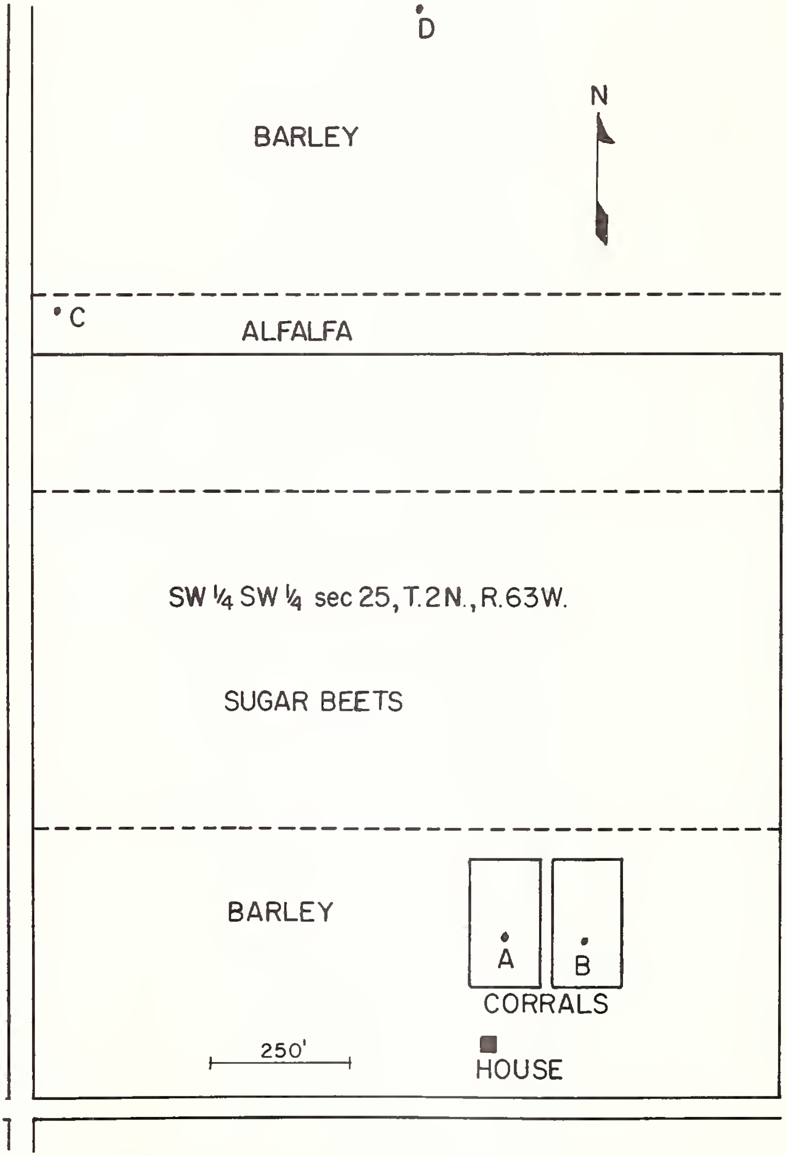


Figure 25.--Location 13 and core sites, near Prospect, Colo.

Irrigated Fields: Alfalfa, sugar beets, barley and corn are grown, but in no particular rotation. With the exception of alfalfa, the same crop is never grown in 2 successive years on the same field. Core C was drilled in an area that had been in alfalfa for 3 years (fig. 25). The area where core D was taken had not had alfalfa grown on it for about 20 years.

Fertilizer Practices: Manure is applied at the rate of 15 tons per acre to the fields every 3 or 4 years. Commercial fertilizer is also used, depending on the crop grown. Corn is fertilized with 100 pounds of N and 60 pounds of P_2O_5 per acre, and sugar beets are fertilized with 60 pounds of N and 60 pounds of P_2O_5 per acre. Barley receives 20 to 30 pounds of P_2O_5 per acre, but no N is added.

Water Quality: The water table has dropped 20 feet since about 1935. Within an irrigation season, the water table will fluctuate 4 feet or more. No difficulty has been experienced with the quality of the well water.

Significant findings:

Cores from the corrals show that nitrate movement is occurring. Considerable quantities of nitrate were found at depths in excess of 40 feet (table 19). Almost no nitrate was found in the cores taken from the alfalfa fields. This finding agrees with analyses of alfalfa field cores from other locations and is probably caused both by the deep rooting zone of alfalfa and by the absence of nitrogen fertilizer additives.

Table 19.--Location 13: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966

Core, depth (ft.) and water sample	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 13-A (corral):							
0-0.2	M	30.8	--	270	--	0.94	700
0.2-0.5	SiL	9.7	--	340	780	.35	90
0.5-1	SiL	10.1	--	390	180	.05	58
1-1.5	SiL	6.7	--	410	--	.04	28
1.5-2	SiL	7.2	--	430	--	.00	0
2-3	SL	4.2	1.1	--	17	.03	2
3-4	SL	4.6	--	430	21	.14	8
4-5	SL	5.1	--	420	18	.05	1
5-6	SL	3.8	3.6	--	13	.05	0
6-7	SL	4.7	--	360	18	.02	--
7-8	SL	3.9	--	380	13	.00	0
8-9	SiL	6.7	2.0	--	23	.05	2
9-10	SiL	7.3	--	340	31	.09	1
10-11	SiL	10.0	--	360	36	.01	1
11-12	SiL	12.9	--	380	33	.03	1
12-13	SiL	15.2	--	390	28	--	1
13-14	SiL	13.1	4.1	--	18	.06	2
14-15	SL	10.2	--	370	16	.01	2
15-16	SiCL	15.8	--	400	19	.02	1
16-17	SiCL	14.2	--	400	30	.02	1
17-18	SL	12.8	--	420	27	--	2
18-19	SL	7.8	3.3	--	21	.15	1
19-20	SL	6.1	--	390	18	.08	1
20-21	S	3.6	--	390	9	.01	1
21-22	S	2.3	--	420	9	--	1
22-23	S	2.7	--	370	15	.03	0
23-24	S	1.9	--	380	10	.01	0
24-25	S	1.8	--	380	--	.00	2
25-26	GS	1.8	--	390	7	.02	3
26-27	GS	1.7	--	370	5	.02	2
27-28	GS	5.1	--	380	4	.01	1
28-29	GS	2.7	--	360	15	.07	2

1/ See table 1 for texture symbols.

Contd.

Table 19.--Location 13: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 13-A (contd.):							
29-30	GS	1.9	--	350	5	0.03	1
30-31	GS	2.4	--	370	4	.00	2
31-32	GS	2.4	--	410	2	.01	0
32-33	GS	2.2	--	340	0	.01	1
33-34	GS	2.3	--	370	0	.00	0
34-35	GS	4.4	--	360	1	.00	0
35-36	GS	5.3	--	400	1	.01	0
36-37	GS	1.9	--	350	1	.02	1
37-38	SC	29.0	--	420	1	.02	1
38-39	SC	27.2	--	350	4	.02	3
39-40	SC	20.9	--	390	2	.01	2
40-41	S	4.6	--	480	1	.01	1
41-42	GS	2.4	--	470	0	.00	1
42-43	GS	2.8	--	450	1	.01	1
43-44	GS	3.4	--	470	0	.01	0
44-45	GS	1.9	--	470	0	.01	1
45-46	GS	2.0	--	450	0	.00	0
46-47	GS	2.2	--	450	0	.02	0
47-48	GS	1.8	--	490	1	.02	1
48-49	GS	2.1	--	490	0	.00	1
49-50	GS	2.2	--	470	0	.01	2
50-51	GS	2.5	--	470	0	.00	0
51-52	GS	3.0	--	430	0	.02	0
52-53	GS	6.5	--	420	6	.02	0
53-60	--	--	--	--	--	--	--
60-61	GS	12.8	--	310	2	.02	1
Water sample				250	8.8	.78	--

Contd.

Table 19.--Location 13: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 13-B (corral):							
0-0.1	M	37.8	--	290	0	0.00	320
0.1-0.3	SiL	6.2	--	300	35	.29	88
0.3-0.5	SiL	6.3	--	350	98	.09	72
0.5-1	SL	6.0	--	380	79	.05	1
1-1.5	SL-G	2.9	--	400	3	.06	0
1.5-2	SL-G	3.8	--	400	14	.09	2
2-3	Sl-G	1.8	2.1	--	11	.12	1
3-4	GS	2.9	--	400	17	.04	2
4-5	GS	2.0	--	320	8	.01	2
5-6	SL-G	5.6	1.1	370	22	.00	0
6-7	SiCL	9.0	--	--	25	.02	1
7-8	SL	8.7	--	380	19	.03	1
8-9	SiL	9.5	1.1	--	19	.01	0
9-10	SL	8.9	--	400	19	.00	0
10-11	SiL	12.3	--	430	24	.00	1
11-12	SiL	12.9	--	400	19	.00	0
12-13	SiL	11.6	--	440	16	.01	1
13-14	SL	3.6	1.0	--	5	.02	1
14-15	SL	5.3	--	410	4	.00	1
15-16	SiCL	10.2	--	380	11	.01	1
16-17	SiCL	9.8	--	430	10	.01	1
17-18	SiCL	9.4	--	460	7	.01	1
18-19	SiL	5.8	1.0	--	5	.32	--
19-20	SiL	10.6	--	410	11	.00	1
20-21	SiL	7.0	--	450	5	.03	0
21-22	GS	4.1	--	420	4	.05	1.0
22-23	GS	.8	--	420	1	.08	0
23-24	GS	.5	--	430	1	.03	0
24-25	GS	.8	--	410	1	.07	1
25-26	GS	1.0	--	390	1	.14	0
26-27	GS	1.1	--	320	2	.06	1
27-28	GS	.9	--	400	0	.21	1

Contd.

Table 19.--Location 13: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 13-B (Contd.):							
28-29	GS	0.9	--	400	2	0.01	2
29-30	GS	.9	--	390	1	.02	1
30-31	GS	1.6	--	380	4	.02	4
31-32	GS	1.7	--	350	1	.30	1
32-33	GS	3.7	--	410	4	.83	1
33-34	GS	3.1	--	390	4	.53	1
34-35	GS	8.6	--	320	13	1.2	2
35-36	GS	1.5	--	400	3	.17	1
36-37	GS	2.8	--	420	1	.05	0
37-38	C	25.0	--	330	7	.15	2
38-39	SC	15.7	--	400	4	.08	2
39-40	SC-G	11.6	--	420	6	.08	1
40-41	SC-G	6.2	--	420	4	.15	2
41-42	SC	14.3	--	420	3	.06	1
42-43	SC	18.2	--	430	6	.02	1
43-44	GS	5.7	--	440	1	.00	1
44-45	GS	5.2	--	430	1	.02	0
45-46	GS	2.6	--	440	0	.01	0
46-47	GS	6.7	--	400	0	.00	1
47-48	S-C	12.6	--	180	0	.00	1
48-49	GS	2.3	--	390	0	.00	1
49-50	GS	1.8	--	410	0	.00	0
50-51	GS	3.1	--	340	0	.01	0
51-52	GS	2.4	--	360	0	.00	1
52-53	GS	2.9	--	380	0	.00	1
53-54	GS	10.7	--	380	0	.02	1
54-55	GS	11.3	--	400	0	.01	1
55-56	GS	13.5	--	370	1	.02	1
56-57	GS	13.0	--	260	1	.00	1
57-58	GS	11.9	--	230	0	.01	1
Water sample				130	22	3.7	--

Contd.

Table 19.--Location 13: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 13-C (irrigated alfalfa):							
0-0.5	SiCL	21.0	--	430	10	0.13	1
0.5-1	SiCL	19.9	--	460	5	.13	4
1-1.5	SiCL	20.5	--	460	1	.09	1
1.5-2	SiCL	21.1	--	470	1	.12	5
2-3	SiCL	17.4	4.3	--	2	.08	0
3-4	SiCL	17.1	--	470	0	.08	0
4-5	SiL	20.6	--	440	0	.02	0
5-6	SiL	26.1	--	460	0	.04	2
6-7	SiL	15.4	19	--	0	.03	1
7-8	SiL	16.4	--	450	0	.01	1
8-9	SiL	18.7	--	460	0	.01	0
9-10	SiL	15.5	22	--	0	.01	1
10-11	SiL	13.2	--	420	0	.00	0
11-12	SiL	15.3	--	450	0	.01	1
12-13	SiL	14.9	--	470	0	.01	1
13-14	SL	16.7	14	--	0	.01	1
14-15	SL	15.8	--	450	0	.01	1
15-16	SL	12.8	--	480	0	.01	1
16-17	SL	10.8	--	450	0	.01	0
17-18	GS	5.3	--	410	0	.00	0
18-19	GS	3.2	--	430	0	.01	0
19-20	GS	3.8	--	410	0	.01	0
20-21	GS	3.9	--	420	0	.00	0
21-22	GS	3.6	--	390	0	.01	0
22-23	GS	3.4	--	420	0	.01	1
23-24	GS	3.9	--	300	0	.01	0
24-25	GS	4.8	--	330	0	.01	1
25-26	GS	4.0	--	440	0	.00	0
26-27	GS	3.3	--	420	0	.00	0
27-28	GS	2.7	--	450	0	.00	1
28-29	GS	2.0	--	470	0	.00	0
29-30	GS	2.7	--	440	0	.00	0

Contd.

Table 19.--Location 13: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 13-C (contd.):							
30-31	GS	2.9	--	460	0	0.01	1
31-32	GS	2.2	--	420	0	.01	1
32-33	GS	2.4	--	420	0	.00	1
33-34	GS	2.6	--	450	0	.01	0
34-35	GS	3.4	--	460	0	.02	0
35-36	C	25.2	--	490	1	.01	0
36-37	SC	19.6	--	460	0	.00	1
37-38	SC	13.4	--	410	1	.01	0
38-39	SC	11.7	--	420	0	.01	0
39-40	GS	6.0	--	380	0	.01	1
40-41	SL	10.8	--	440	0	.01	1
41-42	SL	23.7	--	360	1	.01	0
42-43	SiCL	26.2	--	410	1	.01	0
43-44	SiCL	26.1	--	480	1	.03	0
44-45	SiL	24.0	--	430	1	.01	0
45-46	S	12.7	--	460	1	.01	2
46-47	GS	2.8	--	370	0	.00	--
47-48	GS	2.7	--	400	0	.02	0
48-49	GS	2.6	--	380	0	.00	1
49-50	GS	1.9	--	410	0	.01	0
50-51	GS	2.2	--	420	0	.00	0
51-52	GS	2.1	--	450	0	.01	1
52-53	GS	2.1	--	370	0	.01	0
53-54	GS	3.3	--	420	0	.01	0
54-55	GS	3.7	--	410	0	.01	1
55-56	GS	4.6	--	420	0	.02	1
56-57	GS	12.1	--	340	1	.01	2
57-58	GS	13.5	--	290	1	.01	1
58-59	GS	10.7	--	350	1	--	0
59-60	GS	11.6	--	350	1	.02	2
60-61	GS	11.0	--	370	1	.02	1
Water sample				-250	10	.15	--

Contd.

Table 19.--Location 13: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 13-D (irrigated field):							
0-0.5	SiCL	14.4	--	430	0	0.03	1
0.5-1	SiCL	15.0	--	460	0	.10	1
1-1.5	SiL	11.8	--	460	0	.00	3
1.5-2	SiL	12.4	--	450	0	.03	1
2-3	SiL	12.9	3.3	--	0	.02	1
3-4	SiL	12.8	--	480	--	.01	0
4-5	SL	19.3	--	480	0	.01	0
5-6	SiL	24.6	4.0	--	0	.01	1
6-7	SiL	21.9	--	280	0	.01	2
7-8	SL	14.9	--	300	--	.02	--
8-9	SiCL	19.3	1.0	--	0	.03	0
9-10	SiCL	15.9	--	400	1	.01	0
10-11	SL	11.2	--	440	0	.00	0
11-12	SL	12.2	--	410	1	.00	0
12-13	SL	13.6	--	440	1	.00	1
13-14	SiL	14.4	4.5	--	1	.02	1
14-15	SiL	15.4	--	410	--	.00	1
15-16	SiL	16.9	--	400	1	.01	1
16-17	SiL	15.0	--	400	0	.00	0
17-18	SiL	13.9	--	440	1	.00	1
18-19	GS	2.6	--	480	0	.01	1
19-20	GS	5.5	--	470	0	.00	0
20-21	GS	5.3	--	370	0	.00	1
21-22	GS	5.4	--	440	0	.02	0
22-23	GS	4.0	--	460	0	--	0
23-24	GS	2.6	--	430	0	.02	1
24-25	GS	2.7	--	460	0	.01	0
25-26	GS	2.7	--	410	0	.00	1
26-27	GS-C	9.9	--	380	0	.01	1
27-28	GS-Si	9.2	--	200	0	--	0
28-29	GS	2.9	--	190	0	.00	1
29-30	GS	3.8	--	400	0	.02	0

Contd.

Table 19.--Location 13: Chemical and physical analyses of cores and water samples taken near Prospect, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 13-D (contd.):							
30-31	GS	2.8	--	420	0	0.00	0
31-32	GS	2.5	--	430	0	.00	1
32-33	GS	2.3	--	450	0	.00	1
33-34	GS	2.7	--	470	0	.01	1
34-35	GS	2.7	--	480	0	--	--
35-36	GS	5.0	--	430	0	.01	0
36-37	GS	3.1	--	390	0	.00	1
37-38	GS	6.8	--	470	0	.00	0
38-39	C	24.8	--	490	0	.01	0
39-40	GS	5.0	--	400	0	.01	0
40-41	GS	7.3	--	420	0	.01	1
41-42	GS	2.8	--	430	0	.01	1
42-43	S-CL	8.8	--	410	1	.03	0
43-44	GS	4.2	--	440	0	.00	0
44-45	GS	3.4	--	430	0	.00	0
45-46	GS	3.5	--	460	0	.01	0
46-47	GS	2.8	--	440	0	.01	0
47-48	GS	2.1	--	420	0	.02	1
48-49	GS	2.4	--	450	0	--	--
49-50	GS	2.5	--	460	0	.01	0
50-51	GS	2.7	--	420	1	.00	0
51-52	GS	3.0	--	430	0	.01	0
52-53	GS	2.6	--	450	0	.01	1
53-54	GS	1.8	--	450	0	.00	1
54-55	GS	3.0	--	400	0	.00	1
55-56	GS	6.0	--	420	1	.00	1

Location No. 14

General Location: 8 miles S. and 2 miles E. of Wiggins, Colo.

General Remarks:

Soils:	Cores A and B - Bresser sandy loam	Slope: 1-3 pct.
	Cores C and D - Heldt sandy loam	Slope: 1-3 pct.
	Cores E, F, G, H - Bresser sandy loam	Slope: 0-1 pct.

Irrigated Fields: No specific crop rotation is followed. The field where cores 14-G and 14-H were obtained is usually planted either to sugar beets or to corn (fig. 26). Alfalfa has never been grown on the field.

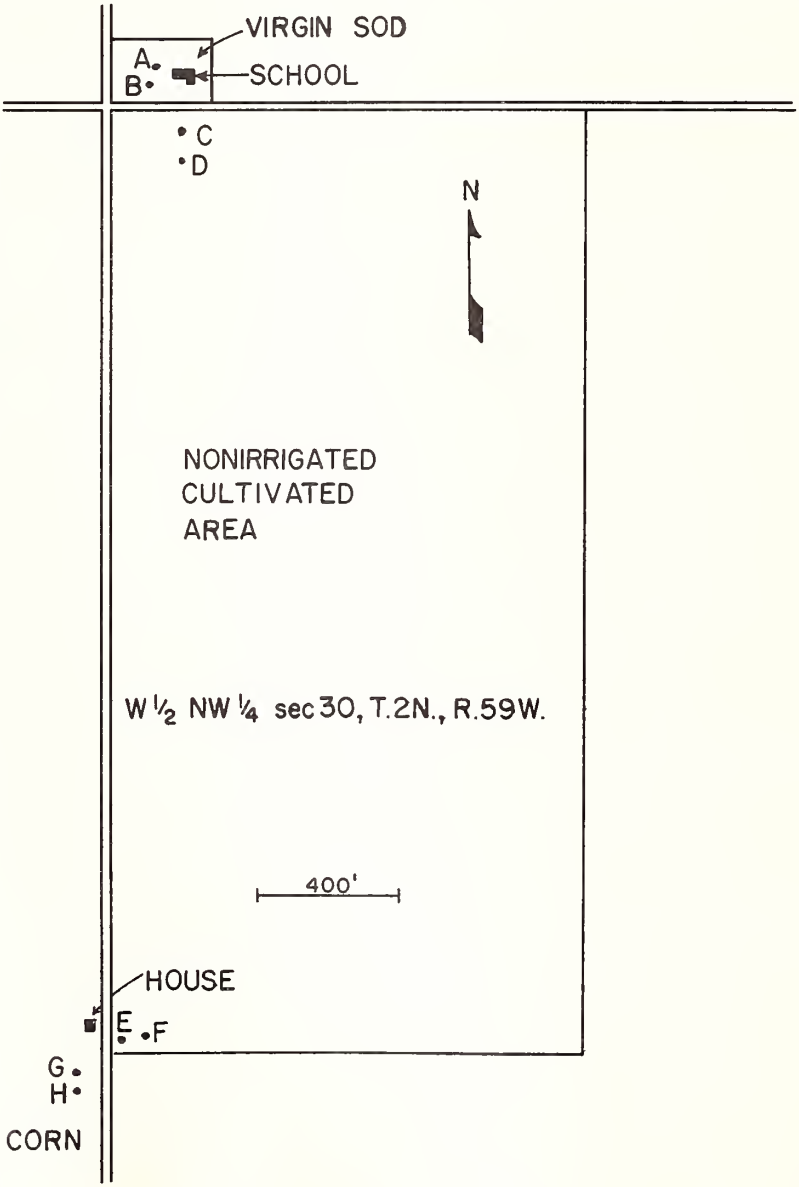


Figure 26.--Location 14 and core sites, near Wiggins, Colo.

Nonirrigated Fields: The school yard has never been plowed. The other nonirrigated areas have been cultivated for at least 50 years, and are generally alternated between wheat and fallow.

Fertilizer Practices: In about 1957, manure at the rate of 12 tons per acre was applied to the irrigated field. Commercial fertilizers are applied according to the crop grown. Corn Receives 100 pounds of N and 100 pounds of P_2O_5 per acre, and sugar beets receive 200 pounds of N and 100 pounds of P_2O_5 per acre. When barley is grown, it receives 60 pounds of N and 40 pounds of P_2O_5 per acre. The nonirrigated wheat-growing area has been fertilized twice, receiving 30 pounds of N per acre with each application. No fertilizer has been applied to the area surrounding the schoolhouse.

Water Quality: No difficulty has been experienced with the water quality. The water table has dropped considerably since 1950 and fluctuates noticeably within each year.

Significant findings:

Two cores were taken from each land use area, but only one of the cores was taken to the water table. The other core represents only the initial 20 feet. Cores 14-A and 14-B were taken from the sod area around the schoolhouse, and cores 14-C and 14-D represent the cultivated area across the road (fig.26). The nitrate concentration was low in all four of these cores, although it was slightly higher in the cores from the cultivated area (table 20). This indicates that some nitrate produced from the decomposition of organic matter during the period of cultivation has leached.

Cores 14-E and 14-F were also taken from the cultivated nonirrigated area, but in a different and higher part of the field. A very high concentration of nitrate was found in these cores. The reason for this is not clear; however, the farmer stated that the barrow pit west of the area where the cores were obtained (fig. 26) has irrigation runoff water in it during most of the irrigation season. There is a possibility that the nitrate accumulation in these cores is the result of nitrate being washed off the irrigated fields into runoff water that moved into the soil at the barrow pit and then moved laterally into the core site area.

Cores 14-G and 14-H were taken from an irrigated cornfield. There was a substantial amount of nitrate at the deeper levels of the core. This indicates that nitrate is being leached through the soil and into the ground water.

Table 20.--Location 14: Chemical and physical analyses of cores and water samples taken near Wiggins, Colo., 1966

Core, depth (ft.) and water sample	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 14-A (nonirrigated sod):							
0-0.5	SL	4.9	--	490	4	0.00	2
0.5-1	SL	5.0	--	520	1	.01	33
1-1.5	SiCL	7.6	--	530	3	.00	3
1.5-2	SiCL	10.8	--	550	5	.00	3
2-3	SL	4.9	1.8	--	1	.00	3
3-4	SC	7.3	--	450	2	.02	3
4-5	S	3.2	--	470	1	.05	3
5-6	GS	1.5	.4	--	1	.06	1
6-7	SiS	14.2	--	70	1	.00	1
7-8	SiS	11.3	--	330	1	.01	2
8-9	S	3.5	.0	--	0	.01	1
9-10	S	4.9	--	390	0	.00	0
10-11	S	6.4	--	450	1	.00	0
11-12	S	6.1	--	380	1	.00	0
12-13	GS	6.9	--	440	0	.00	1
13-14	S	6.8	.3	--	0	.01	0
14-15	SL	9.1	--	490	1	.00	0
15-16	SiC	15.2	--	480	1	.01	0
16-17	SC	15.3	--	420	1	.00	0
17-18	S	10.4	--	440	0	.00	1
18-19	S	6.2	--	--	0	.01	0
19-20	S	11.5	--	390	0	.00	1
20-21	L	8.1	--	420	0	.01	0
Core 14-B (nonirrigated sod):							
0-0.5	SiL	4.3	--	440	0	.00	0
0.5-1	SiL	5.1	--	490	0	.00	5
1-1.5	SiCL	7.4	--	510	0	.00	6
1.5-2	SiCL	7.2	--	520	0	.00	3
2-3	SL	6.2	.0	--	0	.00	5
3-4	SiC	8.1	--	440	0	.02	3
4-5	S	3.6	--	500	0	.00	3
5-6	GS	1.4	--	--	0	.00	4

1/ See table 1 for texture symbols.

Contd.

Table 20.--Location 14: Chemical and physical analyses of cores and water samples taken near Wiggins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 14-B (contd.):							
6-7	GS	4.8	--	380	1	0.01	1
7-8	GS	10.7	--	410	1	.02	0
8-9	GS	7.1	--	--	0	.03	2
9-10	C-GS	12.7	--	430	1	.02	0
10-11	GS	6.8	--	440	0	.02	1
11-12	GS	5.0	--	420	0	.02	0
12-13	GS	6.7	--	470	0	.02	1
13-14	GS	5.9	1.4	--	0	.01	1
14-15	GS	9.8	--	450	0	.02	0
15-16	GS	9.1	--	480	0	.02	0
16-17	GS	13.7	--	410	0	.01	1
17-18	SC	17.7	--	390	0	.02	2
18-19	S	8.2	.9	--	0	.02	2
19-20	SC	14.6	--	450	0	.02	0
20-21	S	8.1	--	510	0	.01	1
21-22	SiC	14.8	--	550	0	.03	0
22-23	S	10.6	--	540	0	.02	0
23-24	S	4.9	2.9	--	1	.02	2
24-25	S	3.3	--	490	0	.02	2
25-26	GS	3.1	--	550	1	--	--
26-27	GS	5.8	--	570	1	.00	0
27-28	GS	5.7	--	570	0	.02	0
28-29	GS	3.5	--	570	0	.02	2
29-30	GS	4.0	--	560	0	--	--
30-31	GS	5.1	--	550	1	.02	0
31-32	GS	6.3	--	560	0	.04	0
32-33	GS	5.3	--	560	1	.03	1
33-34	GS	4.1	--	570	0	.03	0
34-35	GS	4.0	--	520	0	--	--
35-36	GS	4.0	--	550	1	.02	1
36-37	GS	5.7	--	550	1	.02	0
37-38	GS	5.7	--	540	1	.02	0

Contd.

Table 20.--Location 14: Chemical and physical analyses of cores and water samples taken near Wiggins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 14-B (contd.):							
38-39	GS	3.0	--	530	0	0.02	1
39-40	GS	4.6	--	520	0	--	--
40-41	GS	5.5	--	540	0	.02	0
41-42	GS	4.1	--	510	1	.02	0
42-43	GS	4.1	--	540	0	.03	2
43-44	GS	5.3	--	500	0	.05	2
44-45	GS	7.5	--	430	0	--	0
45-46	GS	15.9	--	460	1	.01	0
46-47	GS	17.6	--	468	1	.03	0
47-48	GS	13.4	--	496	1	.01	0
48-49	GS	17.7	--	484	1	--	--
Water sample					2.2	--	.3
Core 14-C (nonirrigated cultivated field):							
0-0.5	SL	8.4	--	520	8	0	3
0.5-1	SL	10.5	--	530	4	0	2
1-1.5	SL	10.0	--	550	0	0	2
1.5-2	SL	6.1	--	530	0	0	5
2-3	SL	1.4	0.3	--	0	0	1
3-4	SL	3.0	--	550	1	0	0
4-5	SL	19.9	--	560	0	--	--
5-6	S	2.3	.6	--	0	0	1
6-7	S	4.4	--	490	0	.04	2
7-8	S	6.1	--	550	1	.03	0
8-9	S	3.1	2.7	--	0	.00	1
9-10	S	4.3	--	480	0	.02	0
10-11	S	8.0	--	530	1	.02	2
11-12	S	4.5	--	480	1	.00	0
12-13	S	4.3	--	490	0	.02	1
13-14	S	7.4	4.7	--	1	.01	0
14-15	SiC	12.4	--	500	1	.03	1
15-16	S	6.2	--	480	1	.03	0
16-17	S	6.9	--	470	0	.05	3
17-18	S	7.7	--	510	0	.02	0

Contd.

Table 20.--Location 14: Chemical and physical analyses of cores and water samples taken near Wiggins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 14-C (contd.):							
18-19	SiC	27.7	5.5	--	2	0.02	1
19-20	SC	19.3	--	450	1	--	--
20-21	SC	16.6	--	490	2	.02	0
21-22	SC	17.3	--	570	3	.00	1
22-23	SC	18.8	--	570	3	.01	0
23-24	SC	12.3	2.6	--	1	.01	1
24-25	S	6.4	--	560	1	.01	0
25-26	S	4.4	--	600	1	.00	0
26-27	S	5.8	--	550	0	.01	1
27-28	S	4.2	--	580	1	.01	0
28-29	S	4.4	--	580	1	.00	1
29-30	S	4.4	--	560	1	.00	0
30-31	GS	8.6	--	550	1	.01	1
31-32	GS	6.6	--	490	1	.00	0
32-33	GS	3.6	--	510	1	.01	1
33-34	GS	3.4	--	520	1	.00	1
34-35	GS	4.6	--	540	0	.01	1
35-36	GS	5.8	--	490	0	.00	1
36-37	GS	5.5	--	510	1	.00	--
37-38	GS	5.1	--	520	1	.00	0
38-39	GS	7.3	--	470	1	.01	0
39-40	GS	5.9	--	530	0	.00	0
40-41	GS	5.4	--	540	0	.00	0
41-42	GS	7.2	--	520	1	.02	0
42-43	GS	4.6	--	550	0	.00	1
43-44	GS	7.4	--	460	0	.00	0
44-45	GS	5.3	--	530	0	.01	0
45-46	GS	4.5	--	500	0	.01	1
46-47	GS	4.0	--	530	0	.00	2
47-48	GS	4.5	--	480	0	.03	0
48-49	GS	10.3	--	460	1	.00	0
49-50	GS	12.2	--	500	0	.00	1

Contd.

Table 20.--Location 14: Chemical and physical analyses of cores and water samples taken near Wiggins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 14-C (contd.):							
50-51	GS	10.1	--	340	0	0.01	0
51-52	GS	12.2	--	500	0	.01	1
52-53	GS	17.4	--	420	1	.00	3
53-54	GS	12.8	--	250	0	.00	0
Water sample				-380	5.0	.23	.2
Core 14-D (nonirrigated cultivated field):							
0-0.5	SL	9.3	--	590	3	.00	0
0.5-1	SiCL	16.6	--	580	1	.00	1
1-1.5	SiCL	18.8	--	590	0	.01	4
1.5-2	SL	10.6	--	580	1	.00	1
2-3	SL	5.1	1.3	--	0	--	--
3-4	SL	6.0	--	440	0	.02	2
4-5	SL	6.2	--	460	0	.00	0
5-6	S	2.2	--	--	0	--	--
6-7	S	4.3	--	410	1	.01	1
7-8	S	6.5	--	460	1	.01	0
8-9	S	3.9	1.1	--	1	.00	0
9-10	S	7.4	--	430	1	.02	2
10-11	S	4.5	--	360	0	--	--
11-12	S	7.4	--	430	--	.03	1
12-13	SC	16.5	--	460	2	.03	2
13-14	SCL	15.9	1.7	--	2	.07	1
14-15	S	12.1	--	500	1	.06	2
15-16	S	4.6	--	520	1	.04	--
16-17	S	14.1	--	470	1	.06	--
17-18	S	8.6	--	470	1	.04	--
18-19	SiCL	18.2	1.2	--	2	.04	2
19-20	SiCL	18.5	--	470	2	--	--
20-21	SiCL	19.1	--	500	2	.05	1

Contd.

Table 20.--Location 14: Chemical and physical analyses of cores and water samples taken near Wiggins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 14-E (nonirrigated cultivated field):							
0-0.5	SCL	8.4	--	540	10	0.00	1
0.5-1	SCL	12.1	--	570	5	.00	1
1-1.5	SCL	13.1	--	550	2	.00	1
1.5-2	SCL	12.7	--	540	1	.01	1
2-3	SiCL	18.1	1.3	--	1	.05	1
3-4	SiCL	22.5	--	470	1	.06	--
4-5	SiCL	20.2	--	460	1	.01	1
5-6	S	2.9	1.2	--	3	.00	1
6-7	S	5.9	--	410	11	.00	0
7-8	S	14.3	--	450	37	.02	0
8-9	S	5.1	1.3	--	21	.02	0
9-10	S	8.1	--	400	27	.00	0
10-11	S	4.4	--	430	14	.01	0
11-12	S	7.6	--	430	19	.01	0
12-13	S	12.3	--	460	17	.00	0
13-14	S	6.1	1.0	--	11	.02	0
14-15	S	7.9	--	460	18	.02	1
15-16	S	.4	--	470	25	.01	0
16-17	S	10.6	--	470	36	.00	0
17-18	SiC	26.4	--	470	53	.02	0
18-19	SiC-G	8.0	.2	--	17	.02	0
19-20	GS	5.1	--	470	16	.00	1
20-21	S	6.2	--	480	16	.00	0
21-22	S	9.9	--	440	25	.00	0
22-23	S	10.6	--	460	32	.01	2
23-24	S	5.3	3.5	--	18	.03	0
24-25	S	4.9	--	460	14	.01	0
25-26	S	10.9	--	490	28	.01	0
26-27	S	7.8	--	300	18	.04	0
27-28	S	7.4	--	360	21	.02	0
28-29	S	14.0	3.2	--	36	.04	0
29-30	S	9.2	--	490	20	.00	1

Contd.

Table 20.--Location 14: Chemical and physical analyses of cores and water samples taken near Wiggins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 14-E (contd.):							
30-31	S	13.6	--	490	15	0.00	0
31-32	S-C	10.4	--	440	9	.00	0
32-33	S-C	11.5	--	460	8	.00	1
33-34	S-C	9.4	6.5	--	3	.01	1
34-35	S-C	12.0	--	470	4	.01	1
35-36	S	4.4	--	490	2	.00	1
36-37	S	4.5	--	430	1	.00	0
37-38	S	4.7	--	450	2	.00	0
38-39	S	3.5	--	470	1	.00	0
39-40	GS	3.7	--	470	1	.00	0
40-41	GS	4.2	--	470	1	--	--
41-42	GS	4.7	--	470	1	--	--
42-43	GS	5.2	--	470	0	.00	0
43-44	GS	4.9	--	450	1	.00	0
44-45	GS	4.7	--	480	0	.00	0
45-46	GS	6.1	--	470	0	.00	1
46-47	GS	6.9	--	470	0	.00	1
47-48	GS	4.4	--	400	0	.03	1
48-49	GS	5.4	--	360	0	.02	0
49-50	GS	6.6	--	370	2	.00	0
50-51	GS	6.4	--	430	1	.01	1
51-52	GS	4.3	--	520	0	.01	1
52-53	GS	4.6	--	520	0	.02	1
53-54	GS	6.1	--	530	0	.01	0
54-55	GS-C	13.5	--	480	1	.00	0
55-56	S-C	16.1	--	540	2	.00	0
56-57	S-C	20.6	--	550	2	.01	1
57-58	SC	9.4	--	-110	0	.00	0
58-59	SC	11.3	--	-150	0	.00	1
59-60	SC	9.0	--	380	0	.00	1
60-61	SC	6.1	--	400	0	.01	0

Contd.

Table 20.--Location 14: Chemical and physical analyses of cores and water samples taken near Wiggins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 14-F (nonirrigated cultivated field):							
0-0.5	SL	--	--	530	11	0.02	2
0.5-1	SL	11.1	--	550	3	.02	2
1-1.5	SL	7.6	--	530	1	.02	0
1.5-2	SL	3.8	--	540	--	.05	1
2-3	SL	5.7	0.6	--	0	.01	1
3-4	SiCL	10.3	--	530	0	.09	1
4-5	S	6.4	--	560	1	.04	1
5-6	S	5.4	1.4	--	2	.02	1
6-7	S	2.6	--	460	1	.00	1
7-8	SiC	12.7	--	470	7	.00	1
8-9	S	5.8	2.7	--	6	.02	1
9-10	S	10.1	--	400	7	.01	1
10-11	S	3.8	--	450	5	.00	1
11-12	S	3.6	--	530	7	.00	1
12-13	S	12.6	--	520	11	.00	0
13-14	S	4.9	.2	--	6	.00	2
14-15	S	9.1	--	470	14	.01	1
15-16	S	7.1	--	500	16	.01	1
16-17	S	7.9	--	500	30	.01	1
17-18	C	24.6	--	490	50	.00	2
18-19	S	4.4	.8	--	14	.02	0
19-20	S	4.4	--	430	20	.02	0
20-21	S	8.0	--	410	25	.01	0
21-22	S-C	12.0	--	400	37	.01	1
Core 14-G (irrigated field):							
0-0.5	SL	5.1	--	480	27	.01	1
0.5-1	SL	8.0	--	490	25	.01	4
1-1.5	SiCL	12.7	--	470	5	.01	1
1.5-2	SiCL	12.8	--	500	2	.15	0
2-3	SiCL	20.0	.5	--	1	.02	0
3-4	SiCL	23.8	--	490	1	.03	2
4-5	S	6.3	--	500	0	.00	1
5-6	S	4.3	.6	--	0	.00	0

Contd.

Table 20.--Location 14: Chemical and physical analyses of cores and water samples taken near Wiggins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 14-G (contd.):							
6-7	S	1.7	--	500	0	0.00	1
7-8	CL	9.7	--	530	0	.00	1
8-9	SCL	6.0	--	--	0	.00	1
9-10	SCL	5.1	--	520	0	.00	1
10-11	SCL	6.9	--	560	1	.00	0
11-12	S	4.3	--	490	0	.00	1
12-13	S	6.9	--	510	0	.00	1
13-14	S	5.0	0.4	--	1	.00	1
14-15	S	6.5	--	510	0	.00	1
15-16	S	5.9	--	520	1	.00	1
16-17	S	7.4	--	510	1	.00	1
17-18	S	13.6	--	530	1	.00	1
18-19	SL	9.0	.3	--	0	.00	0
19-20	GS	3.8	--	520	0	.00	0
20-21	GS	4.4	--	540	1	.00	1
21-22	CL	16.7	--	490	2	.02	1
22-23	S	4.0	--	490	0	.01	1
23-24	S	3.8	.4	480	1	.00	1
24-25	S	4.1	--	480	1	.01	1
25-26	GS	6.3	--	490	1	.00	0
26-27	SC	7.3	--	510	0	.01	1
27-28	SC	18.2	--	510	2	.01	1
28-29	SC	9.3	--	--	2	.02	0
29-30	SC	9.0	--	460	1	.00	0
30-31	SC	7.3	--	480	1	.00	1
31-32	S	11.0	--	470	5	.00	1
32-33	SC	11.4	--	470	8	.00	1
33-34	S	7.6	1.1	--	5	.00	0
34-35	S	6.9	--	470	6	.00	0
35-36	S	7.9	--	480	6	.00	0
36-37	S	5.5	--	440	4	.00	1
37-38	S	7.7	--	440	9	.01	1

Contd.

Table 20.--Location 14: Chemical and physical analyses of cores and water samples taken near Wiggins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 14-G (contd.):							
38-39	S	7.1	5.8	--	10	0.06	1
39-40	S	3.1	--	460	5	.01	1
40-41	S	4.0	--	460	7	.01	0
41-42	S	4.3	--	430	8	.00	0
42-43	S	5.8	--	460	9	.00	1
43-44	GS	12.1	--	430	--	.01	1
44-45	GS	3.9	--	420	10	.01	1
45-46	GS	6.3	--	180	12	.01	1
46-47	GS	6.7	--	360	8	.02	1
47-48	GS	4.2	--	440	5	.01	1
48-49	GS	9.9	--	400	10	.01	1
49-50	GS	7.3	--	390	7	.01	1
50-51	GS	4.5	--	420	4	.01	1
51-52	GS	5.8	--	290	4	.01	1
52-53	GS	6.5	--	360	4	.00	1
53-54	GS	10.6	--	400	5	.01	1
54-55	S	19.1	--	470	3	.01	1
55-56	SC	23.3	--	480	3	.02	1
56-57	SC	24.5	--	440	1	.01	1
57-58	SC	21.3	--	440	1	.02	1
58-59	SC	14.4	--	360	1	.00	2
Water sample				380	10	4.5	0
Core 14-H (irrigated field):							
0-0.5	SL	2.9	--	560	3	.00	0
0.5-1	SL	5.6	--	530	18	.01	1
1-1.5	SiCL	7.4	--	530	10	.01	1
1.5-2	SiCL	11.4	--	520	4	.02	1
2-3	SiCL	24.5	.0	--	1	.03	0
3-4	SiCL	18.2	--	550	1	.01	1
4-5	S	4.7	--	560	0	.00	1
5-6	S	3.5	1.8	--	0	.00	0

Contd.

Table 20.--Location 14: Chemical and physical analyses of cores and water samples taken near Wiggins, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 14-H (contd.):							
6-7	S	4.5	--	410	1	0.01	1
7-8	S	13.7	--	460	1	.01	1
8-9	S	6.3	1.5	--	1	.01	1
9-10	S	12.8	--	440	1	.01	1
10-11	S	4.6	--	410	0	.01	0
11-12	S	5.0	--	470	0	.00	0
12-13	S	8.4	--	480	1	.00	0
13-14	S	6.0	--	--	1	.00	1
14-15	S	6.5	--	470	1	.00	0
15-16	S	6.7	--	490	1	.01	1
16-17	CL	11.3	--	440	2	.01	0
17-18	CL	24.2	--	460	3	.01	1
18-19	CL	10.4	3.8	--	1	.00	1
19-20	GS	4.4	--	450	1	.01	1
20-21	GS	5.0	--	470	1	.01	1

Location No. 15

General Location: 8 miles S. and 4 miles E. of Wiggins, Colo.

General Remarks:

Soils: Cores A and B - Bijou sandy loam Slope: 0-1 pct.
Cores C, D, and E - Bresser sandy loam Slope: 0-1 pct.

Corrals: The corrals are 20 to 25 years old and are used continuously (fig. 27). They generally contain about 150 cattle. The manure is removed once a year, usually in the fall, and hauled to the fields.

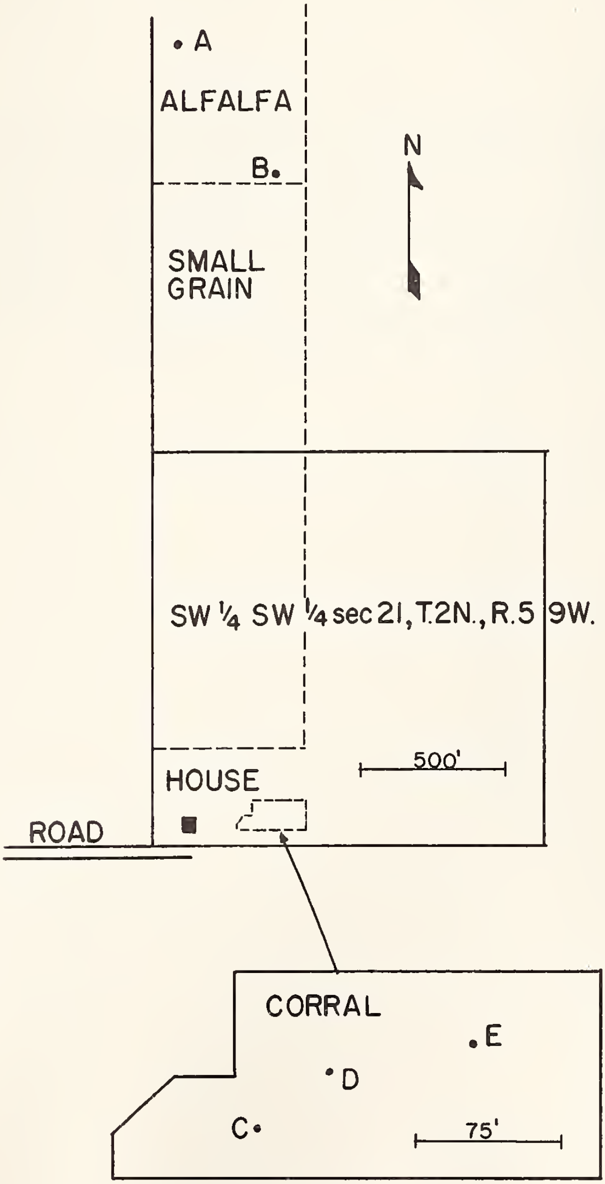


Figure 27.--Location 15 and core sites, near Wiggins, Colo.

Irrigated Fields: Sugar beets, corn, and alfalfa are the chief crops grown, but no specific rotation is followed. The field from which cores A and B were obtained had been in alfalfa for 3 years. Corn and sugar beets, in that order, preceded the alfalfa.

Fertilizer Practices: Manure is applied to the fields every 3 to 4 years, although the alfalfa field from which the cores were obtained has received no manure since about 1956. The commercial fertilizers used varied according to the crops and latest recommendations.

Water Quality: The farmer has experienced no difficulties with the water quality.

Significant findings:

Five cores were obtained at this location (fig. 27), but only two were taken to depths approaching the water table. The other cores represent only the first 20 feet. Cores from the alfalfa field showed very little nitrate present (table 21), except for the first 2 feet and at depths below 40 feet. The nitrate at the lower depths may represent leaching losses of N applied to crops grown before alfalfa. The corral cores showed rather large amounts of nitrate in the first 20 feet. Core E, the only corral core drilled below 20 feet, showed almost no nitrate at the lower depths.

Table 21.--Location 15: Chemical and physical analyses of cores taken near Wiggins, Colo., 1966

Core and depth (ft.)	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 15-A (irrigated alfalfa):							
0-0.5	SL	13.4	--	340	3	0.01	1
0.5-1	SL	12.9	--	420	3	.01	2
1-1.5	SiCL	23.8	--	420	2	.00	5
1.5-2	SiCL	27.3	--	430	3	.01	1
2-3	SiCL	34.5	1.6	--	7	.00	1
3-4	SiCL	10.9	--	450	1	.03	1
4-5	SL	9.1	--	480	0	.01	1
5-6	SL	5.5	.6	--	0	.00	1
6-7	S	6.2	--	360	0	.00	1
7-8	S	5.1	--	370	0	.00	2
8-9	S	3.7	--	420	0	.00	1
9-10	S	2.4	--	450	0	.01	1
10-11	S	3.8	--	310	0	.00	0
11-12	S	2.8	--	300	0	.00	0
12-13	S	2.5	--	370	0	.00	1
13-14	S	4.1	--	430	0	.00	0
14-15	S	5.2	--	400	0	.00	1
15-16	S	5.5	--	370	0	.00	1
16-17	S	5.5	--	390	0	.01	1
17-18	S	5.8	--	430	0	.00	0
18-19	S	5.1	--	420	0	.00	0
19-20	S	6.4	--	420	--	.00	1

Contd.

1/ See table 1 for symbols.

Table 21.--Location 15: Chemical and physical analyses of cores taken near Wiggins, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 15-B (irrigated alfalfa):							
0-0.5	SL	10.4	--	370	12	0.01	24
0.5-1	SL	9.2	--	400	3	.02	1
1-1.5	SL	8.0	--	420	3	.02	1
1.5-2	SL	7.0	--	390	1	.03	0
2-3	SL	6.9	1.5	--	--	.00	2
3-4	SL	8.0	--	410	1	.00	0
4-5	SiC	21.0	--	410	1	.02	0
5-6	SiC	19.0	1.5	--	0	.01	1
6-7	SiC	13.3	--	430	0	.00	1
7-8	SiC	11.5	--	440	0	.00	1
8-9	S	6.8	1.4	--	0	.00	0
9-10	S	3.2	--	480	0	.00	0
10-11	S	2.6	--	480	0	.00	0
11-12	S	6.4	--	480	0	.00	0
12-13	S	6.3	--	430	0	.00	1
13-14	S	6.6	--	380	0	.00	0
14-15	S	7.2	--	380	1	.00	1
15-16	S	5.0	--	390	0	.00	0
16-167	S	4.4	--	400	0	.00	1
17-18	S	6.7	--	450	0	.00	1
18-19	S	6.7	--	480	0	.00	1
19-20	S	6.5	--	420	0	.00	1
20-21	S	6.8	--	450	0	.00	0
21-22	S	7.5	--	430	0	.00	1
22-23	S	6.6	--	390	0	.00	1
23-24	S	16.7	--	410	0	--	1
24-25	S	7.2	--	400	0	--	0
25-26	S	8.7	--	470	0	.00	0
26-27	S	8.0	--	420	0	.00	0
27-28	L	9.0	--	410	0	.00	1
28-29	L	11.1	--	410	0	.00	1
29-30	L	10.1	--	420	0	.00	1

Contd.

Table 21.--Location 15: Chemical and physical analyses of cores taken near Wiggins, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 15-B (Contd.)							
30-31	L	10.2	--	450	0	0.00	0
31-32	L	10.6	--	460	0	.00	1
32-33	L	11.0	--	450	0	.00	1
33-34	L	8.9	--	440	--	.01	1
34-35	L	8.3	--	410	0	--	1
35-36	SiC	11.5	--	430	1	--	1
36-37	SiC	14.8	--	430	1	.00	3
37-38	L	12.2	--	450	0	.00	1
38-39	SiC	13.1	--	420	0	.00	1
39-40	L	12.4	--	450	--	--	0
40-41	CL	15.6	--	440	0	.00	1
41-42	CL	17.1	--	470	0	.00	1
42-43	SiC	16.2	--	430	1	.00	1
43-44	SiC	14.2	--	450	1	.00	0
44-45	SiC	16.5	--	480	1	.02	1
45-46	SiC	15.1	--	430	1	--	1
46-47	L	14.6	--	430	1	--	1
47-48	L	15.4	--	410	1	.02	1
48-49	L	12.2	--	330	1	--	1
49-50	L	15.5	--	450	1	--	1
50-51	L	11.4	--	470	1	.01	1
51-52	L	7.7	--	400	1	--	1
52-53	L	8.7	--	380	1	--	1
53-54	CL	14.0	--	420	1	.00	1
54-55	CL	17.9	--	440	1	--	1
55-56	CL	16.5	--	430	1	.03	0
56-57	CL	16.6	--	460	1	--	1
57-58	CL	17.6	--	290	1	--	1
58-59	CL	19.1	--	320	1	.00	1
59-60	SiC	17.8	--	450	1	.09	1
60-61	SiC	18.9	--	490	2	.02	2
61-62	L	12.1	--	470	2	.01	0
62-63	L	13.9	--	430	2	.02	0

Contd.

Table 21.--Location 15: Chemical and physical analyses of cores taken near Wiggins, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^--N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 15-C (corral):							
0-0.2	M	82.5	--	70	0	0.00	1,200
0.2-0.4	M	85.4	--	-80	0	.00	1,600
0.4-0.7	M	76.9	--	50	0	1.00	1,300
0.7-1	M	76.8	--	50	0	.70	700
1-1.3	SL	12.5	--	140	0	.00	240
1.3-1.6	SL	11.1	--	170	0	.07	18
1.6-2	SCL	11.3	--	180	0	.11	60
2-3	SCL	10.5	6.4	--	6	.09	3
3-4	SCL	11.5	--	190	17	.03	1
4-5	SL	8.5	--	200	13	.01	1
5-6	SL	7.7	11	--	12	.09	1
6-7	SL	10.2	--	260	11	.06	1
7-8	SCL	15.5	--	290	14	.00	1
8-9	SCL	11.0	.9	--	10	.01	1
9-10	SCL	10.2	--	320	9	.00	1
10-11	S	6.7	--	320	6	.00	0
11-12	S	7.9	--	320	8	.00	1
12-13	S	8.2	--	330	9	.00	1
13-14	S	6.2	--	350	--	.00	1
14-15	S	5.5	--	350	4	.00	1
15-16	S	4.4	--	360	7	.00	0
16-17	S	4.8	--	380	10	.02	1
17-18	S	6.2	--	280	17	.04	1
18-19	S	6.7	--	270	18	.07	1
19-20	S	6.6	--	340	23	.10	1
20-21	S	6.8	--	360	23	.20	1

Contd.

Table 21.--Location 15: Chemical and physical analyses of cores taken near Wiggins, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 15-D (corral):							
0-0.2	M	52.9	--	100	5	1.6	390
0.2-0.5	SL	11.7	--	230	5	26	33
0.5-1	SL	11.4	--	260	5	3.0	2
1-1.5	SL	11.0	--	300	34	.39	4
1.5-2	SL	9.6	--	300	10	.43	2
2-3	SL	12.6	0.0	--	44	1.2	3
3-4	SiL	11.8	--	310	3	.04	3
4-5	SL	9.0	--	320	7	.02	0
5-6	SiL	7.1	.0	--	7	.10	0
6-7	SL	5.4	--	350	4	.12	0
7-8	SL	5.0	--	380	4	.04	1
8-9	SL	9.5	1.3	--	12	.03	0
9-10	SL	9.1	--	390	12	.06	1
10-11	SL	10.7	--	410	20	.03	0
11-12	S	10.7	--	390	17	.03	0
12-13	S	9.4	--	400	13	.01	1
13-14	S	4.8	.0	--	4	.04	1
14-15	GS	5.1	--	410	5	.01	1
15-16	GS	5.4	--	420	3	.02	1
16-17	GS	5.6	--	370	1	.01	1
17-18	GS	2.7	--	390	1	.09	1
18-19	S	5.3	--	390	1	.20	0
19-20	S	5.8	--	420	1	.33	0

Contd.

Table 21.--Location 15: Chemical and physical analyses of cores taken near Wiggins, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 15-E (corral):							
0-0.1	M	78.3	--	230	--	0.00	420
0.1-0.3	SL	13.2	--	180	0	--	--
0.3-0.5	SL	12.6	--	240	0	.08	190
0.5-1	SL	13.6	--	270	5	4.5	98
1-1.5	SL	9.2	--	290	0	.25	1
1.5-2	SCL	8.8	--	300	0	.05	2
2-3	CL	25.4	.9	--	30	.12	2
3-4	CL	24.7	--	350	25	.08	3
4-5	CL	24.0	--	350	28	.01	2
5-6	CL	17.0	.7	--	23	.03	1
6-7	CL	22.1	--	360	27	.00	1
7-8	S	11.2	--	320	11	.00	0
8-9	S	2.3	.7	--	4	.05	1
9-10	S	5.3	--	300	6	.09	2
10-11	SC	11.9	--	340	16	.01	1
11-12	SC	11.7	--	330	10	.01	1
12-13	S	12.7	--	370	12	.00	1
13-14	S	6.9	--	350	5	.02	4
14-15	C	22.7	--	340	2	.05	1
15-16	C	19.5	--	300	0	.01	4
16-17	S	11.1	--	300	0	.00	2
17-18	S	7.5	--	330	0	.00	1
18-19	SC	13.5	--	340	0	.02	2
19-20	S	7.2	--	390	0	.00	1
20-21	S	5.8	--	390	0	.00	1
21-22	S	4.7	--	430	0	.01	0
22-23	S	7.2	--	360	0	.00	2
23-24	S	8.0	--	410	0	.00	1

Contd.

Table 21.--Location 15: Chemical and physical analyses of cores taken near Wiggins, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 15-E (Contd.)							
24-25	S	9.6	--	310	2	0.00	2
25-26	S	9.3	--	330	--	.03	0
26-27	S	9.7	--	400	0	.00	1
27-28	S	10.6	--	420	0	.00	1
28-29	S	9.7	--	370	0	.01	2
29-30	S	7.1	--	310	0	.01	1
30-31	S	7.0	--	320	0	.00	1
31-32	S	6.4	--	330	0	.00	1
32-33	L	14.5	--	330	0	.01	0
33-34	CL	19.4	--	330	0	.01	1
34-35	CL	18.3	--	420	0	.00	0
35-36	CL	18.9	--	440	0	.00	1
36-37	CL	19.0	--	390	0	.00	--
37-38	CL	18.8	--	430	0	.00	1
38-39	CL	17.4	--	290	0	.01	1
39-40	CL	19.3	--	430	0	.00	0
40-41	CL	19.8	--	430	0	.00	1
41-42	CL	20.4	--	400	0	.00	1
42-43	SC	17.6	--	370	0	.00	1
43-44	SC	17.4	--	400	0	.00	2
44-45	C	19.2	--	320	0	.01	1
45-46	C	22.7	--	380	0	.00	1
46-47	SiC	20.0	--	270	1	.02	3
47-48	Si	23.2	--	290	0	.00	1
48-49	L	26.7	--	310	0	.00	1
49-50	C	22.7	--	400	0	.00	1
50-51	SiC	23.5	--	150	0	.00	1
51-52	L	20.4	--	440	0	.00	0

Location No. 16

General Location: 6½ miles E. and 1 mile S. of Fort Morgan, Colo.

General Remarks:

Soils:	Cores A, B, C, D, and F - Nunn loam	Slope: 0-1 pct.
	Core E - Nunn clay loam	Slope: 0-1 pct.

Corrals: The age of the corrals range from 2 to 24 years. Cores A, B, and C were obtained from 24-, 18-, and 16-year-old corrals, respectively (fig. 28). The corrals are used continuously, with approximately 200 cattle in each of the larger pens. The manure is cleaned out and spread on the field twice a year.

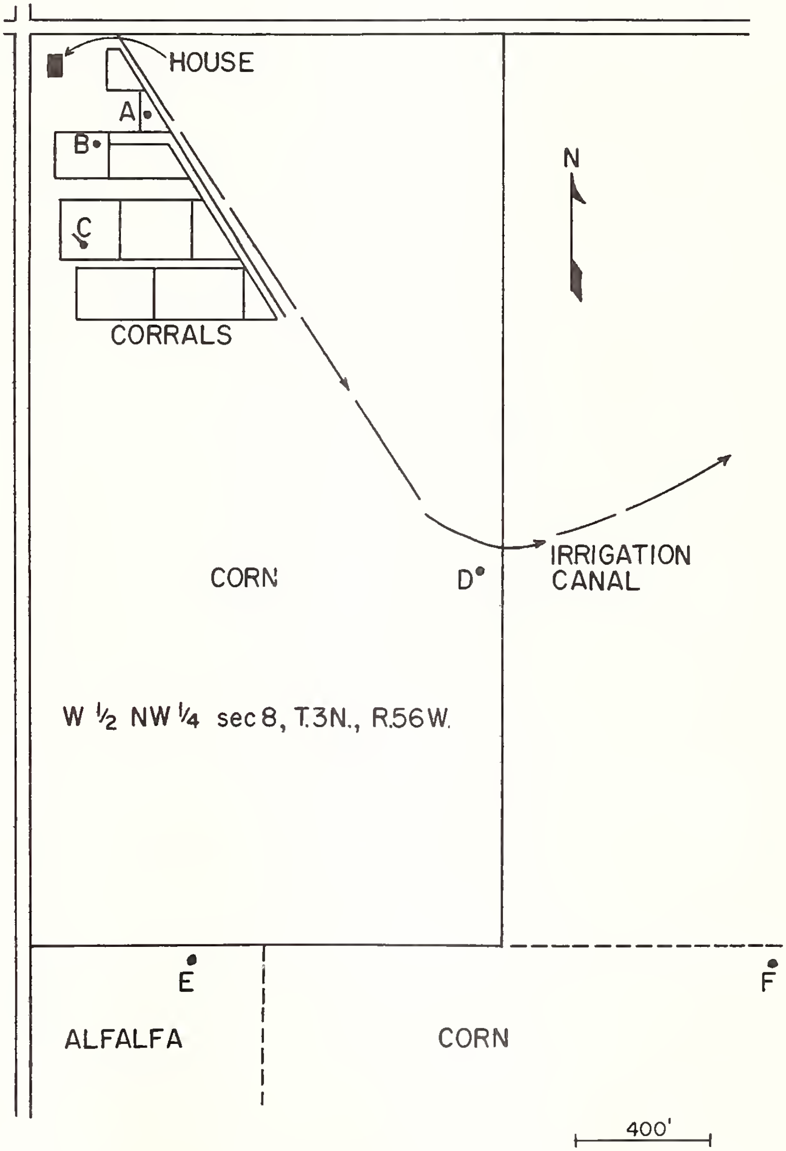


Figure 28.--Location 16 and core sites, near Fort Morgan, Colo.

Irrigated Fields: Alfalfa, corn, and sugar beets are generally rotated. Alfalfa is usually left for 3 years. Core D was obtained from a field that had been in continuous corn for 3 years and in alfalfa for 3 years before the corn. The field from which core F was sampled had not been in alfalfa for 10 years, and corn had been grown the last 4 years. The alfalfa field, where Core E was taken, had been in alfalfa for 1 year, following corn and beets.

Fertilizer practices: Twenty tons of manure are applied to the fields every 2 years. Commercial fertilizer is also applied to the cornfields to furnish an additional 100 to 150 pounds of N and 50 to 60 pounds of P_2O_5 per acre.

Water Quality: The farmer stated that the water is extremely hard. When galvanized pipe was used, the pipe rusted quickly, and the water had a bad odor. The farmer is now using plastic pipe and says the water has no odor.

The depth to water is approximately 32 to 35 feet, and the depth varies from 1 to 3 feet during the season. The water depth has dropped about 6 feet since 1957.

Significant findings:

Cores obtained from corrals 16-A, 16-B, and 16-C had high concentrations of nitrate for the first several feet, but were relatively free of nitrate at the lower depths (table 22). The diminution of the levels of nitrate at the lower depths is presumably caused by denitrification. Evidence supporting denitrification is given by the nitrite data in table 22, by total salts and water-soluble carbon data, and by microbiological analyses (fig.6). Total salts and carbon data show these constituents of core 16-B to be much larger than those of cores from irrigated fields (cores 16-E and 16-F) in the same location. Microbiological studies also show much larger populations of microorganisms at all depths under the corrals, and the larger populations tend to correspond to the higher nitrite levels. When all of these data are considered, there is strong reason to believe that denitrification is substantial.

The cores from the cornfield (16-D and 16-F) have much higher nitrate levels than the core from the alfalfa field (16-E). Nitrate was present in the cornfield cores at all depths, in contrast with the corral cores, which were almost devoid of nitrates at the lower levels. The nitrite concentrations were also much lower. These findings suggest that whereas denitrification is an important factor in the diminution of nitrate levels under the corral sites, it is not a significant agent in the decrease of the nitrate levels under the irrigated fields.

Table 22.--Location 16: Chemical and physical analyses of cores and water samples taken near Fort Morgan, Colo., 1966

Core, depth (ft.) and water sample	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 16-A (corral):							
0-0.2	M	16.1	--	360	200	21	770
0.2-0.5	SL	36.5	--	150	3	.22	1,270
0.5-1	SL	34.5	--	280	6	1.3	38
1-1.5	SCL	23.1	--	320	47	--	--
1.5-2	SCL	25.1	--	340	61	.90	3
2-3	SiCL	25.4	--	--	48	.56	2
3-4	CL	22.9	--	400	47	.12	2
4-5	SL	7.9	--	420	27	.07	1
5-6	S	11.5	--	--	23	.02	0
6-7	S	6.5	2.4	390	11	.08	2
7-8	S	5.2	--	410	10	.05	1
8-9	S	15.0	1.1	--	35	--	--
9-10	SL	13.5	--	380	29	.00	0
10-11	SL	13.2	--	410	23	.02	0
11-12	S-Si	20.8	--	380	1	.08	1
12-13	S-Si	16.7	--	420	1	.01	0
13-14	S-Si	7.9	9.4	--	0	--	--
14-15	S-Si	11.3	--	420	0	.07	1
15-16	S-Si	11.5	--	450	3	.04	1
16-17	S-Si	14.2	--	410	1	.00	1
17-18	S-Si	12.8	--	430	0	.00	2
18-19	S	6.6	9.8	--	1	--	--
19-20	S	9.3	--	390	2	.06	0
20-21	S	6.5	--	410	0	.00	1
21-22	S	15.9	--	400	0	.02	0
22-23	S	11.5	--	380	0	.00	1
23-24	S	7.7	--	400	0	.02	1
24-25	GS	4.8	--	390	0	--	--
25-26	GS	5.7	--	430	0	.01	0

1/ See table 1 for texture symbols.

Contd.

Table 22.--Location 16: Chemical and physical analyses of cores and water samples taken near Fort Morgan, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 16-A (contd.):							
26-27	GS	7.6	--	350	0	--	--
27-28	GS	7.0	--	370	0	--	--
28-29	GS	3.6	--	360	0	0.02	--
29-30	GS	4.8	--	400	0	--	--
30-31	GS	4.6	--	380	0	.02	0
31-32	GS	4.7	--	410	0	.02	0
32-33	GS	6.0	--	360	0	.04	1
33-34	GS	4.8	--	390	0	.01	0
34-35	GS	14.9	--	310	0	--	--
35-36	GS	14.8	--	220	3	.03	4
36-37	GS	14.6	--	350	0	--	5
Water sample				40	14	.55	2.6
Core 16-B (corral):							
0-0.1	M	18.3	--	370	0	.05	2,800
0.1-0.3	SiCL	18.0	--	360	0	.58	1,480
0.3-0.5	SiCL	21.9	--	340	5	.39	1,020
0.5-1	SiCL	23.8	--	350	19	.94	340
1-1.5	SiCL	24.5	--	360	77	.83	3
1.5-2	SC	19.4	--	380	41	.26	5
2-3	SiCL	23.4	1.7	--	27	.11	3
3-4	CL	23.3	--	400	20	.22	5
4-5	S	9.0	--	390	4	1.20	32
5-6	S	4.1	.6	--	3	.08	2
6-7	S	4.8	--	410	3	.07	6
7-8	S	14.1	--	350	8	.09	1
8-9	L	22.7	.4	--	27	.10	2
9-10	S	14.5	--	450	13	.03	1
10-11	S	16.3	--	440	7	.01	1
11-12	C	19.1	--	380	6	.03	1
12-13	L	6.6	--	380	2	.00	1
13-14	L	16.7	2.4	--	1	.01	1

Contd.

Table 22.--Location 16: Chemical and physical analyses of cores and water samples taken near Fort Morgan, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 16-B (contd.):							
14-15	S	6.1	--	400	2	.00	2
15-16	L	14.5	--	400	1	.01	0
16-17	S	5.9	--	420	1	.05	0
17-18	S	4.4	--	430	0	.00	1
18-19	S	3.1	1.1	--	0	0.00	1
19-20	S	7.0	--	380	1	.02	2
20-21	S	7.0	--	400	1	.00	1
21-22	S	4.2	--	410	1	.02	1
22-23	S	4.8	--	430	1	.00	1
23-24	S	10.4	1.4	--	0	.01	1
24-25	S	5.2	--	390	1	.00	1
25-26	S	2.6	--	400	0	.04	1
26-27	GS	1.6	--	350	0	.00	1
27-28	GS	2.1	--	420	0	.01	2
28-29	GS	3.8	--	410	0	.01	1
29-30	GS	1.8	--	440	0	.00	1
30-31	GS	2.1	--	440	0	.01	0
31-32	GS	4.8	--	500	0	.01	0
32-33	GS	7.5	--	480	0	.00	2
33-34	GS	16.7	--	500	1	.03	2
34-35	GS	16.1	--	460	1	.02	0
35-36	GS	16.5	--	320	1	.04	3
Water sample				100	1.1	.53	38
Core 16-C (corral):							
0-0.2	M	15.2	--	280	70	.14	730
0.2-0.5	SCL	18.0	--	300	90	.93	250
0.5-1	SL	12.8	--	340	120	.09	4
1-1.5	SiL	12.8	--	350	25	.09	1
1.5-2	SiL	15.4	--	360	21	.06	2
2-3	SL	11.9	0	--	9	.03	4
3-4	SL	5.7	--	380	2	.01	1
4-5	SL	5.3	--	400	1	.02	3
5-6	S	3.8	1.1	--	0	.03	1

Table 22.--Location 16: Chemical and physical analyses of cores and water samples taken near Fort Morgan, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 16-C (contd.):							
6-7	S	10.3	--	390	1	0.00	2
7-8	S	8.6	--	420	0	.00	1
8-9	S	4.6	2.3	--	1	.01	1
9-10	S	7.2	--	390	1	.00	3
10-11	SiC	19.8	--	430	1	.01	1
11-12	SiC	25.8	--	430	1	.02	2
12-13	S	6.6	--	450	0	.00	1
13-14	S	4.1	.9	--	0	.02	1
14-15	S	5.2	--	380	1	.02	1
15-16	S	4.6	--	480	0	.02	4
16-17	S	6.6	--	490	1	.02	1
17-18	S	2.9	--	490	0	.02	2
18-19	S	2.4	--	460	1	.03	2
19-20	S	2.6	--	490	0	.04	1
20-21	S	3.0	--	490	0	.02	2
21-22	S	2.5	--	510	0	.06	1
22-23	S	3.0	--	540	0	.02	2
23-24	S	2.7	--	500	0	.02	1
24-25	S	4.4	--	500	0	.02	1
25-26	GS	2.2	--	460	0	.02	1
26-27	GS	1.6	--	440	1	.02	2
27-28	GS	1.8	--	450	0	.05	3
28-29	GS	2.6	--	460	0	.02	2
29-30	GS	2.3	--	450	0	.01	1
30-31	GS	2.8	--	450	0	.01	1
31-32	GS	14.1	--	430	1	.06	3
32-33	GS	17.3	--	390	1	.09	2
33-34	GS	19.5	--	360	1	.03	1
34-35	GS	16.2	--	380	1	.01	--
Water sample				180	.5	5.9	10

Contd.

Table 22.--Location 16: Chemical and physical analyses of cores and water samples taken near Fort Morgan, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 16-D (irrigated field):							
0-0.5	SCL	14.3	--	550	6	0.06	1
0.5-1	SiCL	15.9	--	550	13	.08	2
1-1.5	SiCL	24.3	--	560	12	.06	1
1.5-2	SiCL	27.3	--	550	11	.05	1
2-3	SiCL	23.9	0	--	8	.06	2
3-4	SiCL	21.1	--	520	8	--	1
4-5	SiCL	22.4	--	510	8	.03	1
5-6	SiCL	15.5	1.0	--	9	.05	1
6-7	SL	8.9	--	470	6	.01	1
7-8	SL	4.9	--	470	3	.02	1
8-9	SL	4.2	2.5	--	2	.02	1
9-10	S	4.5	--	480	2	.00	1
10-11	S	4.2	--	480	2	.00	1
11-12	S	5.3	--	500	2	.00	1
12-13	S	4.4	--	410	2	.01	0
13-14	S	6.8	--	430	2	.02	1
14-15	SiC-S	23.3	--	480	10	.01	1
15-16	SiC-S	14.2	--	480	5	.01	1
16-17	SiC-S	8.3	--	470	2	.01	1
17-18	S	6.9	--	500	2	.00	0
18-19	S	6.4	--	490	3	.00	0
19-20	S	5.9	--	420	2	.01	0
20-21	S	5.5	--	450	2	.01	0
21-22	S	7.2	--	460	2	.01	1
22-23	S	4.4	--	450	1	.00	0
23-24	GS	2.0	--	450	1	.00	1
24-25	S	9.5	--	510	3	.01	0
25-26	S	7.6	--	400	3	.01	2
26-27	GS	3.0	--	450	1	.00	1
27-28	GS	--	--	410	1	--	1
28-29	GS	4.0	--	470	1	.00	1
29-30	GS	2.6	--	450	1	.01	1

Contd.

Table 22.--Location 16: Chemical and physical analyses of cores and water samples taken near Fort Morgan, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 16-D (contd.):							
30-31	GS	6.3	--	440	2	0.02	1
31-32	GS	2.4	--	440	1	.01	0
32-33	GS	12.1	--	460	3	.00	0
33-34	GS	14.1	--	430	2	.01	0
34-35	GS	16.3	--	410	2	.04	0
Water sample				430	18	.06	0
Core 16-E (irrigated field)							
0-0.5	SiCL	12.3	--	390	4	.12	1
0.5-1	SiCL	16.3	--	380	2	.10	1
1-1.5	SiCL	19.6	--	390	1	.06	1
1.5-2	SiCL	12.8	--	400	1	.02	2
2-3	SL	12.9	2.3	--	0	.02	1
3-4	SL	14.8	--	430	0	.02	1
4-5	SiCL	20.1	--	460	0	.04	0
5-6	SL	5.9	1.5	--	0	.02	1
6-7	SL	8.9	--	530	0	.00	1
7-8	SL	8.6	--	450	0	.00	0
8-9	S	16.4	25	--	0	.00	0
9-10	S	7.8	--	470	0	.00	0
10-11	SiC	16.6	--	470	0	.00	0
11-12	SiC-S	22.2	--	470	0	.00	0
12-13	SiC-S	20.6	--	490	0	.00	1
13-14	SiC-S	16.8	15	--	2	.00	1
14-15	SiC-S	12.5	--	520	0	.00	0
15-16	SiC-S	15.2	--	480	1	.00	2
16-17	S	6.9	--	520	0	.00	1
17-18	S	6.6	--	520	0	.00	1
18-19	S	7.7	80	--	0	.00	0
19-20	S	15.6	--	570	1	.00	0
20-21	SiC	30.3	--	560	0	.00	1
21-22	SiC	31.6	--	520	1	.00	2

Contd.

Table 22.--Location 16: Chemical and physical analyses of cores and water samples taken near Fort Morgan, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 16-E (contd.):							
22-23	S	17.9	--	480	1	0.00	0
23-24	S	13.9	3.7	--	1	.00	0
24-25	S	10.0	--	570	1	.00	0
25-26	S	4.5	--	550	1	.00	1
26-27	S	4.6	--	540	0	.00	0
27-28	S	5.0	--	520	1	.00	0
28-29	S	1.0	--	--	0	.00	0
29-30	GS	1.3	--	550	1	.00	1
30-31	GS	2.2	--	510	0	.00	0
31-32	GS	2.6	--	510	1	.00	0
32-33	GS	9.0	--	470	1	.01	0
33-34	GS	15.9	--	410	1	.03	1
34-35	GS	19.9	--	420	1	.01	2
Water sample				350	1.9	1.02	1.4
Core 16-F (irrigated field):							
0-0.5	SL	14.8	--	450	9	.29	66
0.5-1	SiCL	17.1	--	440	13	.23	2
1-1.5	SiCL	23.1	--	440	17	.06	2
1.5-2	SiCL	23.2	--	470	9	.03	1
2-3	SiCL	25.4	11	--	6	.05	2
3-4	SiCL	27.5	--	470	12	.03	1
4-5	SL	24.7	--	480	17	.03	1
5-6	SL	11.9	21	--	9	.04	2
6-7	SL	9.2	--	450	6	.00	0
7-8	S	5.5	--	460	3	.00	0
8-9	SiC-S	8.6	2.1	--	8	.01	2
9-10	SiC-S	24.5	--	490	14	.00	1
10-11	SiC-S	17.3	--	460	10	--	0
11-12	S	20.5	--	480	9	.01	0
12-13	SiC	26.3	--	500	12	.01	0
13-14	S	5.4	.3	--	2	--	1

Contd.

Table 22.--Location 16: Chemical and physical analyses of cores and water samples taken near Fort Morgan, Colo., 1966--Continued

Core, depth (ft.) and water sample	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 16-F (contd.):							
14-15	S	12.3	--	490	6	--	0
15-16	S	8.8	--	490	4	0.00	--
16-17	S	12.7	--	460	5	--	0
17-18	S	9.0	--	470	5	.00	0
18-19	S	2.5	--	--	1	.00	0
19-20	S	5.7	--	450	3	.00	0
20-21	S	3.8	--	470	1	.00	0
21-22	S	3.0	--	490	1	.00	0
22-23	S	3.5	--	460	1	--	2
23-24	GS	2.1	--	470	1	.00	0
24-25	GS	2.8	--	430	1	--	1
25-26	GS	1.7	--	460	1	.00	0
26-27	GS	5.4	--	470	1	.00	0
27-28	GS	4.2	--	480	1	.00	0
28-29	GS	3.7	--	330	1	.00	1
29-30	GS	3.3	--	310	1	.00	2
30-31	GS	18.6	--	380	2	--	1
31-32	GS	21.4	--	370	1	.01	0
32-33	GS	19.7	--	310	1	.01	0
Water sample				300	17	.10	1.1

Location No. 17

General Location: 4½ miles E. of Brush, Colo.

General Remarks:

Soils: Valentine sand Slope: 3-10 pct.

Corrals: A large group of corrals are located on this area. Several thousand cattle are fed continuously. The corrals range in age from 3 to 15 years. The two corrals used in this study were 3 and 12 years old (fig. 29). Cores A and B were obtained from the 12-year-old corral, and core C was taken from the 3-year-old corral. Approximately 500 head of cattle are fed in each of the corrals. The manure is scraped into piles as necessary, and is hauled away about every 2 years.

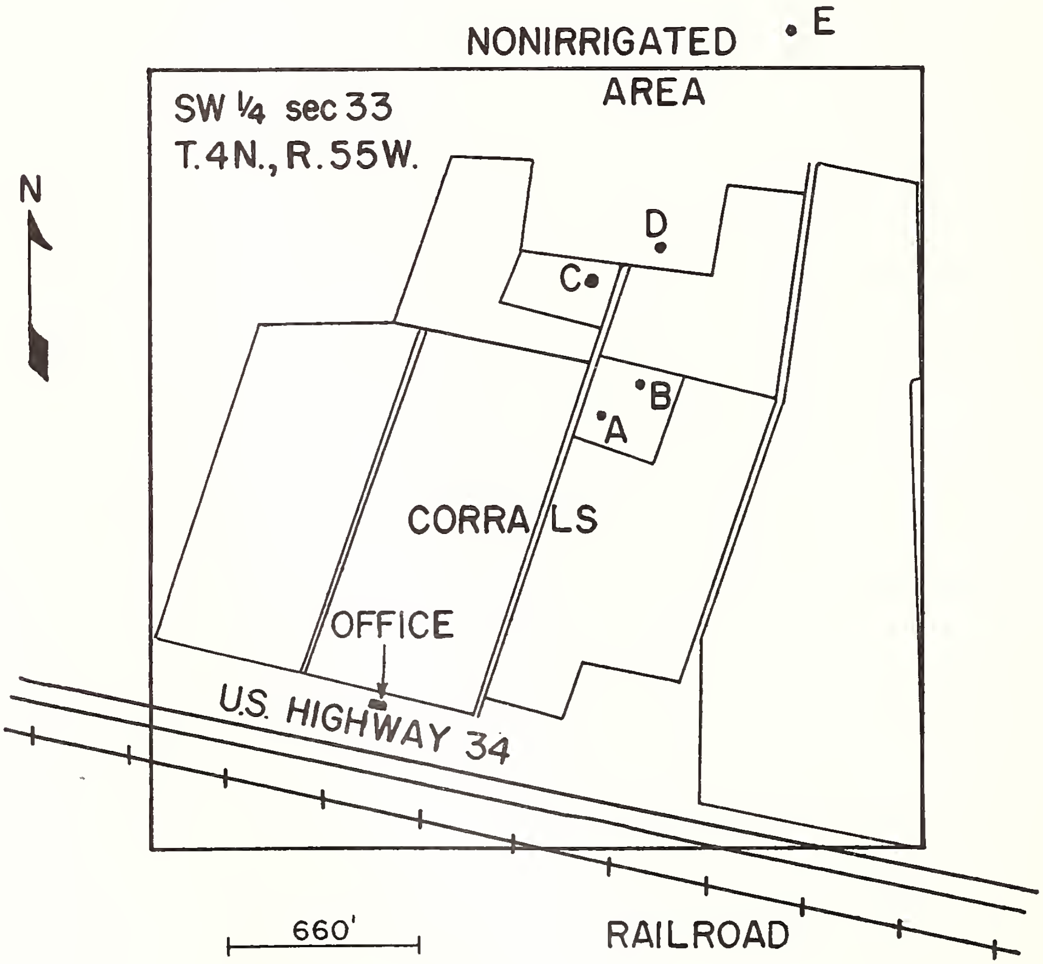


Figure 29.--Location 17 and core sites, near Brush, Colo.

Nonirrigated Area: The area surrounding the corrals is native rangeland and has not been fertilized.

Significant findings:

The area represented by this location is very sandy with a complex slope. A slight water table is present at about 60 feet, but only one of the cores (core 17-B) obtained was drilled to that depth (table 23). Almost no nitrate was found in the corral cores. Undoubtedly, the absence of nitrate was the result of the low oxidation potential, which, for the first several feet of all of the corral cores, was lower than that believed necessary for the accumulation of nitrates (7, 9). The cores from the virgin rangeland surrounding the corrals showed a small concentration of nitrate below the rooting zone.

Table 23.--Location 17: Chemical and physical analyses of cores taken near Brush, Colo., 1966

Core and depth (ft.)	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 17-A (corral):							
0-0.2	M	32.6	--	140	0	0.00	4,780
0.2-0.4	M	39.7	--	270	0	.00	5,320
0.4-0.7	M	52.6	--	330	0	.00	6,410
0.7-1	M	70.8	--	340	0	.00	6,320
1-1.5	M	36.5	--	300	5	.00	4,320
1.5-2	M	37.0	--	220	--	.00	370
2-2.5	M	39.5	--	230	0	.00	1,570
2.5-3	M	27.4	--	220	0	.00	2,150
3-3.5	M	36.9	--	220	0	.00	2,150
3.5-4	M	25.0	--	240	0	.00	1,550
4-4.5	S	3.9	--	230	0	.02	2,650
4.5-5	S	3.3	--	250	0	.04	270
5-6	S	4.1	0.0	--	0	.02	19
6-7	S	4.3	--	300	0	.13	20
7-8	S	4.8	--	310	0	.40	9
8-9	S	5.0	--	330	0	.05	7

1/ See table 1 for texture symbols.

Contd.

Table 23.--Location 17: Chemical and physical analyses of cores taken near Brush, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 17-A (contd.):							
9-10	S	4.8	--	310	0	0.23	5
10-11	S	3.7	--	340	0	.08	4
11-12	S	3.5	--	340	0	.01	4
12-13	S	2.1	--	340	0	.00	3
13-14	S	3.5	1.5	--	0	.01	8
14-15	S	6.3	--	340	0	.01	13
15-16	S	3.4	--	350	0	.01	0
16-17	S	12.0	--	360	0	.02	3
17-18	S	3.2	--	360	0	.02	0
18-19	S	3.2	--	--	0	.01	37
19-20	S	2.8	--	360	0	.00	6
20-21	S	2.9	--	360	0	.00	1
21-22	S	3.6	--	370	0	.00	2
22-23	S	3.6	--	370	0	.01	1
23-24	S	3.6	--	480	0	.02	1
24-25	S	4.3	--	450	0	.02	1
Core 17-B (corral):							
0-0.2	M	54.3	--	370	0	0.00	5,700
0.2-0.4	M	67.9	--	350	0	.00	8,400
0.4-0.7	M	71.2	--	320	0	.00	9,000
0.7-1	M	32.1	--	260	0	.00	3,500
1-1.5	M	14.1	--	220	0	.00	270
1.5-2	S	1.2	--	250	0	.06	19
2-3	S	2.6	0.0	--	0	.07	7
3-4	S	3.3	--	330	0	.17	0
4-5	S	4.5	--	370	0	.23	1
5-6	S	4.5	.7	--	0	.27	36
6-7	S	3.9	--	350	0	.19	7
7-8	S	3.9	--	370	0	.01	0
8-9	S	4.0	3.0	--	0	.01	20
9-10	S	3.9	--	380	0	.02	11
10-11	L	7.5	--	410	0	.02	9
11-12	L	8.6	--	440	0	.00	2

Contd.

Table 23.--Location 17: Chemical and physical analyses of cores taken near Brush, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 17-B (contd.):							
12-13	S	9.2	--	440	0	0.00	2
13-14	S	1.0	--	--	0	.00	1
14-15	S	1.0	--	370	0	.00	2
15-16	S	1.3	--	440	0	.00	1
16-17	S	1.0	--	430	0	.00	1
17-18	S	1.1	--	450	0	.00	1
18-19	S	1.5	--	--	0	.00	11
19-20	S	1.2	--	450	0	.00	1
20-21	S	0.9	--	460	0	.01	1
21-22	S	1.1	--	470	0	.00	1
22-23	S	1.0	--	460	0	.00	6
23-24	S	1.2	--	450	0	.00	1
24-25	S	1.4	--	400	0	.01	15
25-26	S	2.9	--	400	0	.01	6
26-27	S	2.2	--	420	0	.00	19
27-28	S	2.1	--	450	0	.00	1
28-29	S	1.7	--	440	0	.01	2
29-30	S	1.7	--	450	0	.01	2
30-31	S	1.6	--	420	0	.01	2
31-32	S	2.1	--	450	0	.01	14
32-33	S	1.3	--	430	0	.01	2
33-34	S	0.3	--	460	0	.00	2
34-35	S	1.0	--	450	0	.00	2
35-36	S	1.4	--	520	0	.01	1
36-37	S	1.6	--	520	0	.00	2
37-38	S	2.2	--	520	0	.01	1
38-39	S	2.5	--	500	--	0	2
39-40	S	2.4	--	480	0	.02	2
40-41	S	2.4	--	520	0	.01	1
41-42	S	3.1	--	470	0	.02	4
42-43	S	4.1	--	360	0	.01	3
43-44	S	4.9	--	390	0	.01	2

Contd.

Table 23.--Location 17: Chemical and physical analyses of cores taken near Brush, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 17-B (contd.):							
44-45	S	3.0	--	390	0	0.00	5
45-46	S	--	--	--	--	--	--
46-47	S	--	--	--	--	--	--
47-48	S	2.6	--	390	0	.01	1
48-49	S	2.9	--	410	0	.01	5
49-50	S	2.7	--	390	0	.02	2
50-51	S	3.1	--	420	0	.00	3
51-52	S	--	--	--	--	--	--
52-53	S	3.4	--	390	0	.01	2
53-54	S	3.0	--	450	0	.01	2
54-55	S	2.7	--	350	0	.06	2
55-56	S	2.9	--	430	0	.05	2
56-57	S	--	--	--	--	--	--
57-58	S	3.2	--	380	0	.00	2
58-59	S	4.3	--	400	0	.02	1
59-60	S	6.0	--	350	0	.03	2
60-61	S	9.0	--	320	0	.03	1
61-62	S	--	--	--	--	--	--
62-63	S	16.1	--	440	1	.01	1
63-64	S	16.1	--	430	1	.00	1
64-65	S	13.2	--	360	0	.14	7
Core 17-C (corral):							
0-0.2	M & S	24.4	--	280	0	.06	1,140
0.2-0.4	M & S	25.5	--	240	0	.00	2,290
0.4-0.7	M & S	27.3	--	70	0	.00	2,080
0.7-1	M & S	25.7	--	250	0	.00	2,690
1-1.5	S	4.6	--	220	0	4.50	255
1.5-2	S	2.9	--	290	0	1.90	141
2-3	S	2.4	--	--	2	.04	0
3-4	S	1.8	--	340	5	.06	5

Contd.

Table 23.--Location 17: Chemical and physical analyses of cores taken near Brush, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 17-C (Contd.)							
4-5	S	1.6	--	360	8	.02	1
5-6	S	1.6	0.0	--	8	.10	3
6-7	S	1.5	--	360	7	.06	19
7-8	S	1.4	--	390	8	.00	0
8-9	S	2.0	.0	--	6	.05	0
9-10	S	1.4	--	390	5	.01	1
10-11	S	1.5	--	400	5	.00	1
11-12	S	2.1	--	410	10	.00	2
12-13	S	2.1	--	430	6	.00	1
13-14	S	3.9	.0	--	1	.01	1
14-15	S	2.6	--	450	0	.01	4
15-16	S	4.0	--	460	0	.00	2
16-17	S	4.3	--	460	0	.00	1
17-18	S	4.4	--	460	0	.00	1
18-19	S	2.2	.0	--	0	.03	9
19-20	S	1.8	--	460	0	.00	1
20-21	S	1.7	--	450	0	.01	2
21-22	S	2.9	--	430	0	.01	2
22-23	S	2.1	--	450	0	.00	1
23-24	S	1.6	--	--	1	.02	3
24-25	S	1.9	--	460	0	.00	1
25-26	S	2.2	--	420	0	.00	1
Core 17-D (corral):							
0-0.5	S	2.7	--	480	9	.11	6
0.5-1	S	0.6	--	530	1	.00	1
1-1.5	S	0.6	--	540	1	.01	0
1.5-2	S	3.6	--	510	1	.02	--
2-3	S	1.7	17	--	1	.02	0
3-4	S	1.7	--	500	1	.00	0
4-5	S	2.7	--	510	3	.01	0
5-6	S	2.8	.0	--	4	.12	0

Contd.

Table 23.--Location 17: Chemical and physical analyses of cores taken near Brush, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 17-D (Contd.)							
6-7	S	3.2	--	470	5	0.02	0
7-8	S	4.5	--	470	7	.01	1
8-9	S	2.1	.8	--	1	.00	2
9-10	S	2.0	--	450	1	.01	1
10-11	S	2.3	--	440	1	.01	0
11-12	S	2.3	--	450	1	.01	1
12-13	S	1.9	--	460	1	.00	1
13-14	S	2.1	6.0	--	1	.02	2
14-15	S	2.3	--	460	1	.01	0
15-16	S	2.2	--	430	1	.01	0
16-17	S	2.6	--	490	1	.00	0
17-18	S	2.2	--	500	1	.01	2
18-19	S	2.5	1.8	--	1	.01	1
19-20	S	2.8	--	390	1	.01	0
20-21	S	2.7	--	460	0	.00	1
21-22	S	3.1	--	420	0	.00	1
22-23	S	2.8	--	460	0	.01	0
23-24	S	2.2	3.0	--	1	.01	0
Core 17-E (nonirrigated sod):							
0-0.5	S	5.9	--	550	5	.01	3
0.5-1	S	1.5	--	600	1	.01	1
1-1.5	S	1.2	--	600	0	.01	4
1.5-2	S	1.3	--	600	0	.01	1
2-3	S	1.3	--	--	1	.01	2
3-4	S	1.6	--	560	1	.01	1
4-5	S	2.9	--	590	1	.01	1
5-6	S	3.7	.0	--	1	.02	2
6-7	S	4.5	--	540	2	.01	1
7-8	S	5.0	--	570	2	.01	1
8-9	S	3.8	--	--	2	.02	1
9-10	L	8.3	--	530	8	.02	1

Contd.

Table 23.--Location 17: Chemical and physical analyses of cores taken near Brush, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 17-E (Contd.)							
10-11	S	5.3	--	550	3	0.01	1
11-12	L	3.0	--	550	1	.01	1
12-13	L	5.3	--	560	1	.01	0
13-14	S	2.3	.0	--	1	.01	1
14-15	S	2.8	--	370	0	.01	0
15-16	S	2.7	--	440	0	.01	1
16-17	S	3.3	--	450	0	.01	0
17-18	S	2.9	--	470	1	.01	0
18-19	S	3.5	.0	--	0	.01	0
19-20	S	4.2	--	410	0	.00	1
20-21	S	2.4	--	410	0	.01	1
21-22	S	3.6	--	460	0	.00	0
22-23	S	1.9	--	420	1	.01	2
23-24	S	2.3	.0	410	0	.01	1
24-25	S	1.9	--	390	0	.01	1
25-26	S	3.2	--	--	1	.00	0
26-27	S	5.1	--	450	0	.01	0
27-28	S	4.0	--	390	0	.03	0
28-29	S	2.6	--	430	0	.01	2
29-30	S	2.9	--	450	0	.01	0
30-31	S	3.0	--	430	0	.01	0
31-32	S	3.0	--	450	0	.01	1
32-33	S	3.4	--	460	0	.02	0
33-34	S	2.6	--	420	0	.01	1
34-35	S	2.0	--	450	0	.01	0
35-36	S	2.3	--	410	0	.01	1
36-37	L	23.5	--	450	0	.01	2
37-38	L	14.9	--	440	0	.01	1
38-39	L	16.4	--	430	0	.01	2
39-40	L	15.8	--	460	0	.01	1
40-41	L	17.4	--	380	0	.01	1

Location No. 18

General Location: Central Great Plains Field Station located approximately 4 miles E. of Akron, Colo.

General Remarks:

Soils: Cores A, B, C, and D - Rago silt loam Slope: 0-1 pct.
Cores E, F, G, and H - Weld silt loam Slope: 0-1 pct.

Nonirrigated areas: Two sites, each having adjacent virgin sod and cultivated area, were selected (fig. 30). These diversified sites were selected in order to ascertain whether nitrate was more abundant in the profiles of the cultivated areas than in those of the virgin sod. Many studies have shown that considerably more N has been lost from cultivated soils of the Great Plains than can be accounted for by crop removal. In general, possible losses by leaching have been thought to be negligible, as the area is located in a low rainfall belt. No fertilizer has been used on these locations, and the area is not irrigated. The cultivated area north of the road has been in cultivation since 1908, and the area south of the road was first plowed in 1926.

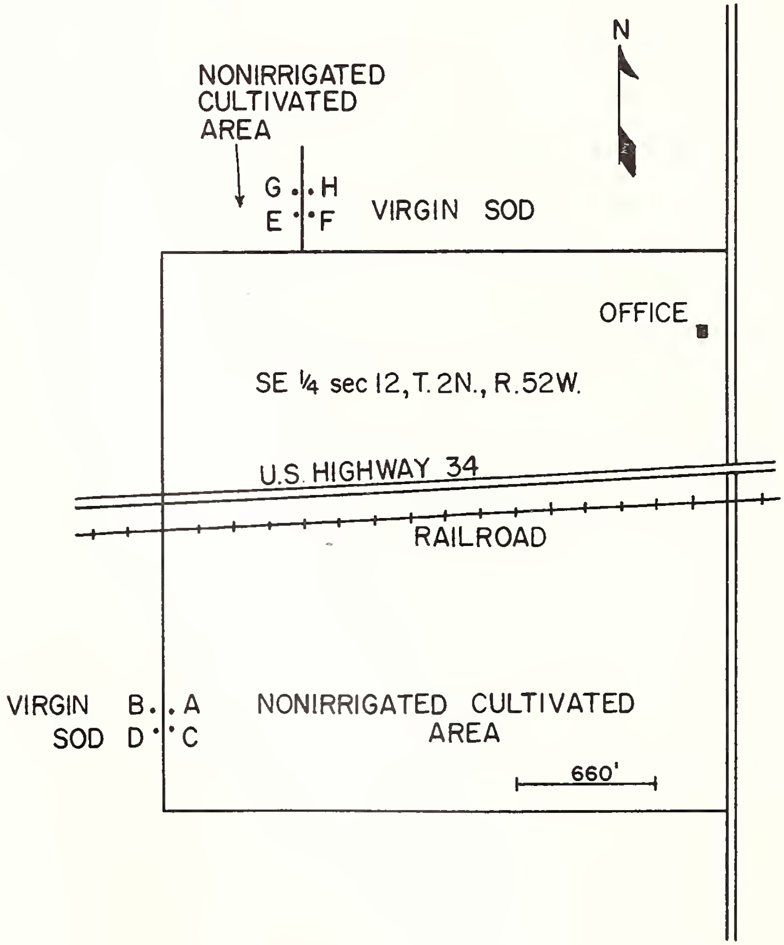

N
NONIRRIGATED CULTIVATED AREA
G
H
E
F
VIRGIN SOD
OFFICE
SE ¼ sec 12, T. 2N., R. 52W.
U.S. HIGHWAY 34
RAILROAD
VIRGIN SOD
B
A
D
C
NONIRRIGATED CULTIVATED AREA
660'

Figure 30.--Location 18 and core sites, near Akron, Colo.

Significant findings:

This location offers a comparison of four cores from virgin sites with four cores from adjoining cultivated sites. There is a distinct difference in the nitrate amounts present in the profiles under the different management practices (table 24). Almost no nitrate was present in the cores taken from the virgin sites, whereas appreciable amounts were found in the cores from the cultivated sites.

Table 24.--Location 18: Chemical and physical analyses of cores taken near Akron, Colo., 1966

Core and depth (ft.)	Texture 1/	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 18-A (nonirrigated cultivated field):							
0-0.5	SiCL	12.3	--	340	15	0.06	2
0.5-1	SiCL	16.6	--	370	3	.03	0
1-1.5	SiCL	17.1	--	390	3	.05	0
1.5-2	SiCL	19.1	--	410	4	.04	1
2-3	SiL	13.3	2.8	--	21	.13	0
3-4	SiL	11.3	--	430	18	.09	1
4-5	L	5.5	--	460	3	.03	1
5-6	L	5.1	7.5	--	2	.03	1
6-7	L	6.1	--	480	2	.01	0
7-8	L	7.5	--	470	12	.01	1
8-9	L	9.9	--	--	13	.01	1
9-10	SC	9.5	--	470	17	.00	1
10-11	SC	9.1	--	460	12	.01	1
11-12	S	7.4	--	450	8	.00	0
12-13	S	7.1	--	490	6	.00	1
13-14	GS	2.3	11.3	--	1	.00	1
14-15	GS	3.0	--	440	2	.00	1
15-16	GS	7.1	--	470	2	.00	1
16-17	C-GS	9.6	--	480	4	.00	1
17-18	C-GS	10.5	--	460	3	.00	1

Contd.

1/ See table 1 for texture symbols.

Table 24.--Location 18: Chemical and physical analyses of cores taken near Akron, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_3^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 18-A (Contd.)							
18-32	--	--	--	--	--	--	--
32-33	Si	14.0	--	440	3	0.01	2
33-34	Si	6.2	--	390	1	.00	2
34-35	Si	6.7	--	380	1	.01	3
35-36	Si	6.2	--	280	1	.01	3
36-37	Si	6.3	--	420	1	.00	
37-38	Si	6.6	--	320	1	.00	2
38-39	Si	6.1	--	330	1	.00	2
39-40	Si	7.3	--	370	1	.00	2
4041	Si	5.8	--	430	1	.00	1
41-42	Si	6.2	--	290	1	.00	2
42-43	Si	7.0	--	380	1	.00	2
43-44	Si	6.5	--	200	1	.00	1
Core 18-B (nonirrigated sod):							
0-0.5	SiCL	7.2	--	380	1	.08	1
0.5-1	SiCL	6.4	--	390	0	.04	2
1-1.5	SiCL	7.3	--	410	1	.03	1
1.5-2	SiCL	10.2	--	410	0	.06	1
2-3	SiL	8.6	0.8	--	1	.03	1
3-4	Si	7.3	--	430	1	.02	1
4-5	Si	6.9	--	440	2	.02	2
5-6	L	6.7	1.3	--	1	.03	2
6-7	L	5.8	--	460	1	--	0
7-8	L	8.4	--	520	0	.00	0
8-9	SC	10.4	3.5	--	1	.00	1
9-10	SC	10.6	--	490	0	.00	0
10-11	SC	9.7	--	520	0	.00	0
11-12	SiC	8.5	--	490	0	.00	0
12-13	SiC-G	8.9	--	480	0	.01	0
13-14	GS	6.3	--	480	0	.00	1

Contd.

Table 24.--Location 18: Chemical and physical analyses of cores taken near Akron, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 18-B (Contd.)							
14-15	GS	5.0	--	470	0	0.02	0
15-16	Si-S-G	11.9	--	450	0	.00	0
16-17	Si-S-G	8.2	--	430	0	.00	1
Core 18-C (nonirrigated cultivated field):							
0-0.5	SiCL	12.4	--	520	10	.04	1
0.5-1	SiCL	17.8	--	500	2	.04	1
1-1.5	SiCL	22.1	--	510	2	.04	0
1.5-2	SiCL	19.1	--	520	2	.03	1
2-3	SiL	16.5	2.9	--	2	.03	1
3-4	Si	15.1	--	510	2	.03	1
4-5	Si	7.3	--	510	1	.02	2
5-6	Si	4.3	1.0	--	0	.02	1
6-7	Si	5.3	--	490	0	.00	0
7-8	L	8.6	--	520	1	.02	0
8-9	SC	8.4	.4	--	2	.01	0
9-10	SC	10.4	--	480	3	.00	1
10-11	SC-G	5.7	--	500	2	.00	0
11-12	GS	1.5	--	440	1	.00	0
12-13	GS	2.2	--	480	2	.00	0
13-14	SC	9.7	--	480	6	.00	1
14-15	SiC	10.0	--	480	8	.01	0
15-16	SiC	13.0	--	490	9	.00	1
16-17	SiC-S	9.2	--	510	5	.00	0
17-18	SiC-S	8.8	--	460	8	.01	0
18-19	L	8.2	--	410	2	.00	0
19-20	L-G	7.2	--	490	0	.00	0
20-21	GS	2.9	--	440	0	.00	1
21-22	GS	3.9	--	450	0	.00	0

Contd.

Table 24.--Location 18: Chemical and physical analyses of cores taken near Akron, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 18-C (Contd.):							
22-23	GS	1.9	--	430	0	0.00	0
23-24	GS	2.3	--	480	0	.00	0
24-25	GS	1.7	--	440	0	.00	1
25-26	L	5.5	--	460	0	.00	1
26-27	L	5.3	--	470	0	.01	0
27-28	GS	3.7	--	440	0	.01	1
28-29	GS	2.7	--	410	0	.00	0
Core 18-D (nonirrigated sod):							
0-0.5	SiCL	6.4	--	550	1	.03	4
0.5-1	SiCL	11.4	--	550	1	.05	2
1-1.5	SiCL	10.8	--	540	0	.08	1
1.5-2	SiCL	8.4	--	540	0	.03	1
2-3	Sil	7.0	2.0	--	0	.02	1
3-4	SiL	7.3	--	470	0	.02	1
4-5	SiL	6.4	--	490	1	.03	1
5-6	L	4.3	--	--	0	.02	1
6-7	L	4.4	--	480	0	.02	1
7-8	L	8.7	--	480	1	.00	1
8-9	S	10.1	2.1	--	0	.00	0
9-10	SC	10.0	--	450	0	.01	1
10-11	SC	6.9	--	490	0	.00	1
11-12	SC-G	6.6	--	460	0	.00	2
12-13	SC-G	5.9	--	450	0	.02	1
Core 18-E (nonirrigated cultivated field):							
0-0.5	SiCL	19.1	--	540	14	.01	1
0.5-1	SiCL	22.3	--	560	8	.02	1
1-1.5	SiCL	20.7	--	560	6	.02	1
1.5-2	SiL	21.4	--	510	7	.01	0
2-3	SiL	15.2	17	--	2	.01	1
3-4	L	14.9	--	470	3	.01	1
4-5	L	12.4	--	470	4	.00	0
5-6	L	13.3	9.3	--	6	.00	1

Contd.

Table 24.--Location 18: Chemical and physical analyses of cores taken near Akron, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 18-E (Contd.)							
6-7	L	14.1	--	480	8	0.01	1
7-8	SiL	12.2	--	510	4	.00	0
8-9	SL	8.0	23	--	2	.01	1
9-10	SL	5.8	--	470	1	.00	0
10-11	S	7.0	--	500	0	.00	1
11-12	SC	15.1	--	480	17	.00	0
12-13	SC	12.8	--	490	14	.00	0
13-14	SC-G	7.9	2.8	--	15	.00	1
14-15	SC-G	7.2	--	480	14	.00	0
15-16	GS	4.9	--	490	7	.00	0
16-17	GS	3.1	--	480	0	.00	0
17-18	SC	14.2	--	500	0	.00	1
18-19	SC	11.7	--	510	1	.00	1
19-20	SC	12.5	--	490	0	.01	1
Core 18-F (nonirrigated sod):							
0-0.5	SiCL	4.4	--	480	0	.01	1
0.5-1	SiCL	7.1	--	540	0	.05	1
1-1.5	SiCL	9.9	--	550	0	.03	0
1.5-2	SiL	7.1	--	570	0	.02	0
2-3	L	4.6	0.6	--	0	.02	1
3-4	L	6.4	--	470	0	.03	1
4-5	L	6.1	--	480	0	.02	1
5-6	L	6.2	1.3	--	1	.01	1
6-7	L	5.7	--	470	0	.00	0
7-8	S	2.4	--	500	0	.00	2
8-9	SL	1.7	--	--	0	.01	0
9-10	S	2.4	--	460	0	.00	1
10-11	S	2.6	--	480	0	.00	1
11-12	SC	5.1	--	480	0	.01	1
12-13	SC	1.2	--	480	0	.01	1
13-14	SC	4.2	--	490	0	.00	1

Contd.

Table 24.--Location 18: Chemical and physical analyses of cores taken near Akron, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	Eh	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	Mv.	p.p.m.	p.p.m.	p.p.m.
Core 18-G (nonirrigated cultivated field):							
0-0.5	SiCL	16.5	--	520	2	0.01	0
0.5-1	SiCL	18.0	--	550	5	.02	1
1-1.5	SiCL	15.2	--	550	3	.01	1
1.5-2	SiL	11.9	--	560	2	.00	1
2-3	SiL	9.2	0.0	--	5	.01	1
3-4	SiL	9.1	--	580	5	.00	1
4-5	SiL	9.6	--	580	5	.00	1
5-6	L	8.4	.6	--	11	.01	1
6-7	L	6.5	--	470	17	.00	1
7-8	L	7.6	--	480	27	.00	1
8-9	SiC-G	10.1	.0	--	9	.00	0
9-10	SiC-G	8.4	--	480	1	.01	1
10-11	SiC-G	8.0	--	500	0	.00	1
11-12	SiC-G	6.5	--	630	0	.00	1
12-13	S	5.1	--	490	1	.01	1
13-14	SC	7.2	--	460	0	.01	1
14-15	SC	7.0	--	420	1	.00	0
15-16	SC	11.1	--	500	0	.01	0
16-17	SC	7.5	--	470	0	.00	1
17-18	SiC	4.1	--	450	0	.00	1
Core 18-H (nonirrigated sod):							
0-0.5	SiCL	5.8	--	521	2	.02	1
0.5-1	SiCL	11.7	--	544	1	.01	1
1-1.5	SiCL	9.8	--	529	0	.03	0
1.5-2	SiL	6.0	--	537	0	.04	1
2-3	SiL	6.0	--	--	0	.03	0
3-4	SiL	8.1	--	469	0	.02	1
4-5	SiL	6.8	--	489	0	.00	0
5-6	Sil-G	13.7	.4	--	0	.01	1
6-7	GS	1.8	--	475	1	.01	1
7-8	GS	1.4	--	435	0	.01	1
8-9	SC	4.2	.0	437	2	.01	1
9-10	GS	3.3	--	459	2	.01	1
10-11	SC	8.9	--	489	8	.01	2

Location No. 19

General Location: 11½ miles S. on Highway 61 of Julesburg, Colo.

General Remarks:

Soils: Cores A and B - Nunn gravelly loam Slope: 3-5 pct.
Cores C and D - Richfield loam Slope: 0-1 pct.

Nonirrigated Area: This area, like location No. 18, was selected for the purpose of comparing nitrates found under a virgin area with those found under an area cultivated for several years (fig. 31). Since about 1925, the cultivated fields at this site have generally been alternated between wheat and fallow. No fertilizer has been applied to any of the fields represented with cores and the areas are not irrigated.

Significant findings:

This location offers a further comparison of the nitrate in cores from virgin and from cultivated sites. Although the magnitude of the differences is much smaller than that found for location 18, the cores from the cultivated areas contained more nitrate than the cores from virgin sites (table 25).

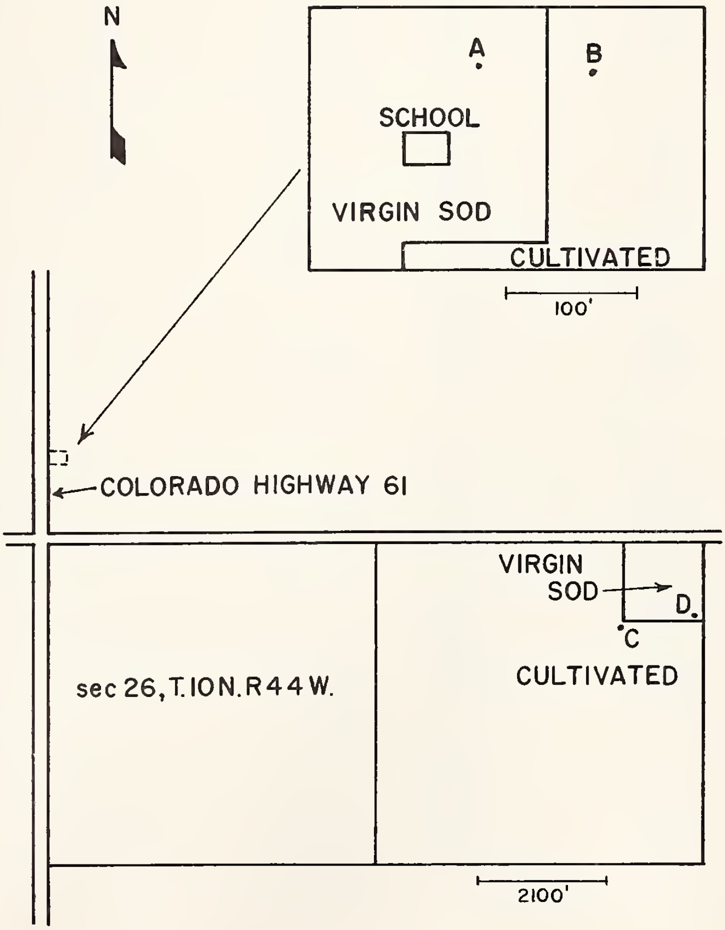


Figure 31.--Location 19 and core sites, near Julesburg, Colo.

Table 25.--Location 19: Chemical and physical analyses of cores taken near Julesburg, Colo., 1966

Core and depth (ft.)	Texture 1/	H_2O	K	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	p.p.m.	p.p.m.	p.p.m.
Core 19-A (nonirrigated sod):						
0-0.5	L	10.6	--	0	0.09	1
0.5-1	L	8.9	--	0	.00	0
1-1.5	L	6.9	--	0	.03	1
1.5-2	L	4.7	--	0	.00	1
2-3	L	2.1	0.0	0	.00	1
3-4	S	2.9	--	0	.00	1
4-5	S	3.4	--	0	--	1
5-6	S	3.2	--	--	.01	1
6-7	S	5.6	--	0	.00	1
7-8	S	4.5	--	0	.00	2
8-9	S	4.2	--	0	.00	2
9-10	S	4.4	--	0	.00	0
10-11	S	5.2	--	0	.01	2
11-12	S	6.0	--	0	.00	1
12-13	S	7.9	--	0	.01	1
13-14	S	8.5	--	0	.00	2
14-15	S	9.2	--	0	.00	1
15-16	S	14.0	--	0	.01	1
16-17	CL	22.1	--	0	.00	3
17-18	CL	17.0	--	0	.00	1
18-19	S	10.8	--	0	.00	2
19-20	S	9.1	--	0	.01	2
20-21	S	9.1	--	0	--	--
21-22	S	9.8	--	0	.00	1
22-23	S	10.5	--	0	.00	1
23-24	S	11.1	--	0	.00	2
24-25	S	12.5	--	0	.00	0
25-26	S	11.1	--	0	.00	2
26-27	S	7.6	--	0	.00	2
27-28	S	5.9	--	0	.00	1
28-29	S	4.7	--	0	.00	1
29-30	S	3.6	--	0	.00	2

Contd.

1/ See table 1 for texture symbols.

Table 25.--Location 19: Chemical and physical analyses of cores taken near Julesburg, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	p.p.m.	p.p.m.	p.p.m.
Core 19-A (Contd.):						
30-31	S	3.2	--	0	0.00	--
31-32	S	3.4	--	0	.00	1
32-33	S	4.4	--	0	.00	1
33-34	S	3.9	--	0	.00	2
34-35	S	3.3	--	0	.00	1
35-36	S	4.8	--	0	.00	1
36-37	S	5.2	--	0	.00	1
37-38	S	6.3	--	0	.01	1
38-39	S	2.9	--	0	.01	1
39-40	S	8.5	--	0	.00	1
Core 19-B (nonirrigated cultivated field):						
0-0.5	L	19.0	--	24	.01	1
0.5-1	L	20.0	--	5	.01	1
1-1.5	L	21.8	--	6	--	1
1.5-2	L	27.2	--	6	.29	2
2-3	S	9.9	--	0	.02	1
3-4	S	7.6	--	1	.00	1
4-5	S	7.9	--	1	.01	1
5-6	S	7.2	--	1	.01	1
6-7	S	7.7	--	1	.00	1
7-8	S	8.2	--	2	.01	2
8-9	S	11.1	--	3	.01	1
9-10	S	10.5	--	--	.01	1
10-11	S	8.3	--	3	.02	2
11-12	S	8.2	--	3	.00	1
12-13	S	8.6	--	2	.00	1
13-14	S	6.8	--	1	.00	1
14-15	S	6.1	--	1	--	--
15-16	S	4.1	--	0	.01	0
16-17	S	5.5	--	0	.00	1
17-18	S	12.6	--	0	.01	1

Contd.

Table 25.--Location 19: Chemical and physical analyses of cores taken near Julesburg, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	p.p.m.	p.p.m.	p.p.m.
Core 19-B (Contd.)						
18-19	S	9.0	--	0	0.02	1
19-20	S	5.3	--	--	.00	1
20-21	S	--	--	--	--	--
21-22	S	8.5	--	0	.00	1
22-23	S	8.4	--	0	.01	1
23-24	S	10.7	--	0	.00	1
24-25	S	8.8	--	0	.00	1
25-26	S	11.8	--	0	.01	1
26-27	S	9.3	--	0	.01	1
27-28	S	8.9	--	0	.00	1
28-29	S	8.2	--	0	.01	1
29-30	S	5.5	--	0	.00	2
30-31	S	3.3	--	0	.00	1
31-32	S	3.3	--	0	.00	1
32-33	S	2.8	--	0	.00	0
33-34	S	3.3	--	0	.00	1
34-35	S	4.2	--	0	.01	1
35-36	S	3.0	--	0	.01	--
36-37	S	2.9	--	0	.00	1
37-38	S	2.8	--	0	.00	1
Core 19-C (nonirrigated cultivated field):						
0-0.5	L	22.6	--	52	.01	1
0.5-1	L	20.5	--	11	.02	5
1-1.5	L	19.3	--	3	.01	0
1.5-2	L	19.1	--	1	.01	1
2-3	S	16.1	0.0	1	.03	2
3-4	S	16.3	--	0	.01	0
4-5	G	11.7	--	1	.00	1
5-6	G	6.6	--	0	.01	1
6-7	G	6.7	--	1	.01	2
7-8	G	5.0	--	1	.01	1
8-9	G	3.2	--	0	.01	0
9-10	G	3.8	--	1	.01	0

Contd.

Table 25.--Location 19: Chemical and physical analyses of cores taken near Julesburg, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	p.p.m.	p.p.m.	p.p.m.
Core 19-C (Contd.):						
10-11	G	3.4	--	1	0.00	0
11-12	G	3.6	--	1	.00	0
12-13	G	3.2	--	0	.00	0
13-14	G	2.7	--	1	.00	0
14-15	G	4.0	--	1	.00	0
15-16	G	2.9	--	1	.00	0
16-17	G	4.9	--	1	.00	0
17-18	G	5.9	--	1	.00	0
18-19	G	6.3	--	2	.00	0
19-20	G	5.5	--	0	.01	0
20-21	G	5.9	--	0	.00	0
21-22	G	5.9	--	1	.00	0
22-23	G	5.3	--	0	.00	0
23-24	G	4.6	--	1	.00	0
24-25	G	4.5	--	0	.00	0
25-26	G	5.5	--	0	.00	0
25-27	G	4.8	--	0	.00	0
27-28	G	4.6	--	0	.00	0
28-29	G	4.9	--	1	.00	1
29-30	G	5.1	--	0	.01	0
30-31	G	5.9	--	0	.01	1
31-32	G	6.2	--	0	.01	1
32-33	G	5.4	--	0	.01	1
33-34	G	4.7	--	0	.01	1
34-35	G	4.5	--	0	.00	1
35-36	G	3.3	--	0	.00	1
36-37	G	3.8	--	0	.01	0
37-38	G	3.2	--	0	.00	1
38-39	G	3.5	--	1	.01	1
39-40	G	3.5	--	0	.01	0

Contd.

Table 25.--Location 19: Chemical and physical analyses of cores taken near Julesburg, Colo., 1966--Continued

Core and depth (ft.)	Texture	H_2O	K	NO_3^--N	NO_2^--N	NH_4^+-N
		Pct.	Cm./yr.	p.p.m.	p.p.m.	p.p.m.
Core 19-D (nonirrigated sod):						
0-0.5	L	24.5	--	2	0.01	2
0.5-1	L	12.9	--	1	--	--
1-1.5	L	8.5	--	0	--	--
1.5-2	L	7.5	--	0	.01	1
2-3	S	4.4	5.0	1	.00	0
3-4	S	4.5	--	0	.01	1
4-5	S	4.0	--	0	.01	0
5-6	S	2.7	1.5	1	.01	1
6-7	S	2.7	--	0	.01	0
7-8	S	2.1	--	0	.00	0
8-9	S	3.7	--	1	.00	0
9-10	S	2.9	--	1	.01	0
10-11	S	9.7	--	0	.01	1
11-12	G	3.1	--	0	.00	0
12-13	G	3.3	--	0	.00	1
13-14	G	3.5	--	1	.00	0
14-15	G	5.0	--	1	.01	1
15-16	G	4.8	--	0	.00	1
16-17	G	4.7	--	0	.00	0
17-18	G	4.7	--	0	.00	1
18-19	G	4.1	--	1	.00	0
19-20	G	5.8	--	0	.00	0
20-21	G	6.1	--	1	.00	0
21-22	G	5.8	--	1	.00	0
22-23	G	5.8	--	0	.01	1
23-24	G	4.3	--	1	.01	1
24-25	G	5.5	--	0	.00	1
25-26	G	5.3	--	1	.00	1

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